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SECOND SERIES: PULMONATA.

# MANUAL

OF

# CONCHOLOGY

## STRUCTURAL AND SYSTEMATIC.

WITH ILLUSTRATIONS OF THE SPECIES.


BY GEORGE W. TRYON, JR.

CONTINUED BY

HENRY A. PILSBRY, Sc. D.,

CONSERVATOR OF THE CONCHOLOGICAL SECTION OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA.


Vol. XII.

AMERICAN BULIMULIDÆ: NORTH AMERICAN AND ANTILLEAN DRYMÆUS, LEIOSTRACUS, ORTHALICINÆ AND AMPHIBULIMINÆ.


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[The present volume completes the account of American *Bulimulidæ*, with the exception of the toothed genera, *Odontostomus*, *Anctus*, *Tomigerus* and *Anostoma*, which form a sub-family to be monographed in the next volume, which will be occupied chiefly with the Australian and Oriental groups of *Bulimulidæ*, completing the monograph of this family.]


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# MANUAL OF CONCHOLOGY.

## Vol. XII—*BULIMULIDÆ.*

### Genus DRYMÆUS Albers. (Continued.)

II. Species of the West Indies, Trinidad and Florida.

With the exception of *D. undulatus* and *D. elongatus* and its immediate allies, the *Drymæus* species of this area form a homogeneous group, undoubtedly derived from the group of allied forms in Venezuela and the adjacent region, which has the same characters. There are also a few species in eastern Mexico belonging to the same group. While some of the species have the expanded lip of typical *Drymæus*, others have no perceptible expansion, and would technically be classed in *Mesembrinus;* but the distinction here is purely artificial, and had better be disregarded. With an identical pattern of sculpture, the various forms show gradations in texture from the excessive fragility of *D. dominicus* to the solidity of *D. liliaceus*. In the more fragile forms, the upper whorls of the spire usually exhibit an excessively dense and minute granulation, below the grated apical portion.

The land snails of the Lesser Antilles are in large measure peculiar to the region; and though there are conspicuous exceptions, the localities on the mainland of South America which authors quote for them are to be received with great caution. There can be no doubt that many such records which have been copied by Pfeiffer in the Monographia, and thence by Mr. Smith in some of his valuable Antillean lists, were based upon errors of determination or false locality labels. Drouet has been particularly unfortunate in the introduction of such errors, and except where the extrinsic evidence corroborates the statements in his "Terrestrial and Fluviatile Mollusks of French Guiana," I do not consider them worthy of quotation. Among the snails credited by him to Guiana, there are many species such as *Helix nuxdenticulata*, *dentiens*, *isabella*, *badia*, *orbiculata*, *Bulimus perversus*, *papy-*

*raceus*, *multifasciatus*, *virgulatus*, *exilis*, *tenuissimus*, *auris-sileni*, *Achatina virginea*, etc., which we cannot, without further confirmation, consider actual inhabitants of that region. See also pp. 39, 40 of volume XI.

Besides the species described below, the following forms have been attributed by Beck to the Antilles:

*Bulimus* (*Bulimulus*) *venustus* Beck, Index Moll., p. 65, "I. Antill."

*Bulimus* (*Bulimulus*) *pugio* Beck, Index Moll., p. 66, "I. Antill."

*Bulimus* (*Bulimulus*) *ochraceus* Beck, Index Moll., p. 67, "I. Antill."

*Bulimus* (*Mastus*) *niveus* Beck, Index Moll., p. 73, "I. Antill."

*Bulimus* (*Cochlicellus*) *subantiquatus* Beck, Index Moll., p. 63, "I. Antill."

All are nude names, unknown to subsequent authors. The *Index Molluscorum* was, according to a MS. note (apparently by Beck) in my copy, projected to consist of three parts, of which "fasciculus 3 nondum publicatus, continet speciarum novarum descriptiones."

D. DORMANI (W. G. Binney). Pl. 5, figs. 14, 15, 16, 17.

Shell umbilicate, ovate-conic, thin (often fragile), white or corneous-white, opaque or somewhat transparent, with (typically) four spiral bands of squarish brown spots, the upper band narrow, often wanting; the spots frequently irregular, oblong, or coalescent vertically or horizontally, or even wholly wanting. Surface smooth, glossy or corroded, with delicate spiral striæ when not effaced. Spire decidedly conic; apex obtuse. Whorls $5\frac{1}{2}$ to 6, the last convex.

Aperture oblique, ovate, showing the external markings within; peristome simple or a trifle expanded, the columellar margin dilated, reflexed.

Alt. 29, diam. 16, length of aperture 15 mill., often smaller.

*Peninsular Florida: mouth of the St. John's River, and Cedar Keys, south to the Caloosahatchie River.*

*Bulimus dormani* W. G. B., Proc. Acad. Nat. Sci., Phila., Oct., 1857, p. 188; Terrestr. Moll. iv, p. 132, pl. 80, f. 10.—PFR., Malak. Bl., 1859, p. 45; Monogr. vi, p. 109.—*Bulimulus dormani* W. G. B., Land and Fresh-water Shells N. A., i, p. 194, f. 339; Proc. Acad. Nat. Sci., Phila., 1876, p. 190 (anatomy); Terrestr. Moll. v, p. 397,

f. 280, pl. x, f. F (teeth), pl. xv, f. J (genitalia); Man. Amer. Land Shells, p. 406, f. 446, 447; Fourth Suppl. Terr. Moll. v (Bull. M. C. Z. xxii, no. 4), p. 191, pl. 1, f. 6.—SIMPSON, Proc. Davenport Acad. Nat. Sciences, v, p. 67.—*Liostracus dormani* TRYON, Amer. Journ. Conch. iii, p. 169, pl. 13, f. 8.—*Drymæus dormani* PILSBRY. Nautilus ix, p. 115.

Larger and more conic than *D. dominicus* (*marielinus*) or *D. maculatus*. Figures 14 and 15 represent the typical form as found in the northern St. John's valley, where it is large, rather opaque, and more or less deficient in basal bands in the adult. Further south in the St. John's valley the shells are generally thinner and smaller, with two or three spot-bands above, and two continuous bands below, the lower one circum-umbilical. While quite variable, *D. dormani* is a perfectly distinct species, not especially close to any other described form. Among other differences, *D dominicus* and its several varieties have the two basal bands contiguous, the lower one not close to the axis.

Var. *albida* B. H. Wright. Pl. 5, figs. 16, 17.

More slender and elongated than the type, whorls as many as $6\frac{1}{2}$; very thin and glossy; whitish-hyaline, somewhat translucent, immaculate or with two or three subcontinuous brown bands, the subperipheral band widest, circum-umbilical and peripheral indistinct.

Alt. 32, diam. $15\frac{1}{2}$, length of aperture $14\frac{1}{2}$ mill.

A "hammock" near *Lake Helen, Florida.* (G. W. Webster.)

*Bulimulus dormani* var. *albida* WRIGHT, Nautilus iv, Oct., 1890, p. 61.—WEBSTER, *t. c.*, p. 86. *Cf.* SIMPSON, *t. c.*, p. 79.—*Bulimulus dormani* forma nov. *subfasciatus* COCKERELL, Zoe ii, p. 18 (April, 1891).

The specimens figured are banded, but as Mr. Webster has pointed out, they vary in the original locality by imperceptible stages from 3-banded to bandless. The bands are represented as too dark and distinct in fig. 16. The narrow contour is characteristic of this local form.

D. DOMINICUS (Reeve). Pl. 20, figs. 30, 31, 32; pl. 5, fig. 26.

Shell subperforate, ovate-conic, *thin and fragile*, yellowish or whitish corneous, more or less translucent, with typically four or five spiral dark-brown bands, the upper three (typically) interrupted into small spots, the lower two continuous or nearly so, *contiguous* and nearly

midway between axis and periphery on the base. Surface smooth, showing light growth lines and fine engraved spirals under the lens, becoming densely and most minutely puncticulate or beaded above. Spire conic, apex usually brown-tipped and with typical *Drymæus* sculpture. Whorls $5\frac{1}{2}$, the last oval, equably rounded, subangular in the immature shell.

Aperture ovate, oblique; peristome thin, simple; columellar margin narrowly reflexed and mainly adnate above.

Alt. $15\frac{1}{2}$, diam. $8\frac{1}{2}$, length of aperture 8 mill. (Porto Plata.)

Alt. $15\frac{1}{2}$, diam. $7\frac{1}{2}$, length of aperture $7\frac{1}{3}$ mill. (Yuma R.)

*Island of Hayti: San Domingo*, without exact locality (Sallé); *environs of Santiago and at Porto Plata* (Hjalmarson), and *Yuma river* (H. Prime). *Cuba: Mariel* (Poey), *Manzanillo*, *Trinidad*, "*la Ferina en Bemba* (Gundlach), *Cayo Carenas*, *near Cienfuegos* (Cisneros). *Florida: Upper Matacumba Key* (Hemphill, Velie), *near Miami river* (Binney), *Micco* (Baker), and *on the west coast at Marco*, *near Charlotte Harbor* (Hemphill), and on the *Caloosahatchie river below Fort Thompson* (C. W. Johnson), with *D. dormani;* also, *Lake Helen* (Wright). *Mexico: Chiapa*, *State of Chiapas* (Ghiesbreght), *State of Tabasco*, *Mirador*, *State of Vera Cruz* (Berendt), *Callejon de la Zamorana*, *near Vera Cruz* (Strebel), *Labna*, *Yucatan* (Heilprin Exped.). *Nicaragua: San Nicolas* (Tate).

Haitian references:—*Bulimus dominicus* Reeve, Conch. Icon. pl. 88, f. 659 (Feb., 1850).—Pfr., Monogr. iii, p. 410.—*Bulimulus dominicus* Crosse, Journ. de Conchyl. 1891, p. 128.

Cuban references:—*Bulimus marielinus* Poey, Memorias sobre la Historia Natural de la Isla de Cuba, i, p. 204, 212, 213, 447, pl. 12, f. 32, 33 (1851).—Pfr., Monogr. iii, p. 406; Malak. Bl., 1854, p. 195.—Arango, Fauna Malac. Cubana, p. 80.—*Bulimus* (*Leptomerus*) *marielinus* Tryon, Amer. Journ. Conch. iii, p. 174, pl. 14, f. 23.—*Bulimulus marielinus* Crosse, Journ. de Conchyl. 1890, p. 200.

Floridian references:—*Bulimulus marielinus* Binney, Land and Fresh-water Shells N. A. i, p. 193, f. 337 (1869); Terrestr. Moll. v, p. 398, f. 281; Man. Amer. Land Shells, p. 408, f. 450.—Dall, Proc. U. S. Nat. Mus., 1885, p. 260.—*Bulimulus floridanus* W. G. Binney, Man. Amer. Land Shells, p. 408, f. 449; Third Suppl. Terr. Moll. v (Bull. M. C. Z. xix, no. 4), p. 201, fig. in text.—

*Bulimus floridanus* Pfr., P. Z. S., 1856, p. 330; Monogr. iv, p. 406. —*Bulimus floridianus* (*sic*) W. G. Binney, Terrestr. Moll. iv, p. 134.—*Bulimulus hemphilli* B. H. Wright, West American Scientist, vi, April, 1889, p. 8 (referring to fig. 449 of Binney's Man. Amer. L. Shells). See also Wright, Nautilus iii, p. 19; iv, p. 61.

Mexican references:—*Bulimulus dominicus* Fischer and Crosse, Miss. Scient. Mex., Moll., i, p. 540.—Strebel, Beitr. Mex. Land und Süsswasser-Conch., iv, pl. 6, f. 17; v, p. 94. See also, von Martens, Biol. Centr. Amer., Moll., p. 237.—*Bulimus maculatus* Lea, Tate, Amer. Journ. of Conch., v, p. 156.

*D. dominicus* is the senior name for a shell existing under various names—*dominicus*, *marielinus*, *floridanus*, *hemphilli*—in Haiti, Cuba, Florida and eastern Mexico. The San Domingo specimens before me from two collectors show conclusively that the doubt expressed by Crosse as to its occurrence there is not well founded, and it is equally certain that the true *dominicus* occurs in eastern Mexico, Yucatan and Nicaragua. Having specimens before me of undoubted authenticity as to locality, I fail to find the slightest grounds for separating the Mexican from the Haitian shells as a variety, much less a species, though on *a priori* grounds I would be inclined to do so if I could.

Reeve's figure (copied on my pl. 5, fig. 26) is faulty in showing the columellar expansion too broad, but is otherwise a good representation of the shells before me from Porto Plata (pl. 20, fig. 31). Those from Yuma R. (pl. 20, fig. 30) are more slender, with the earlier whorls reddish. All of these San Domingo shells have the bands above the periphery spotted, in this respect differing from most, though not all Floridian specimens, in which all the bands are usually subcontinuous.

Mexican shells are very like Haitian. In that described and figured by Strebel, band i (subsutural) is wanting, as in some Haitian, Cuban and Floridian shells. The Labna, Yucatan, shell wants bands i and ii, band iii (peripheral) being dotted, bands iv and v continuous and contiguous. Two specimens collected by Prof. Ralph Tate in Nicaragua, and listed by him under the name "*B. maculatus*" are wholly typical in coloring.

Cuban specimens are either practically typical, like Poey's type of *marielinus* (pl. 5, figs. 24, 25), which has the formula 00345, the

third or third and fourth bands dotted, or they have all the bands subcontinuous as in most Floridian shells.

Floridian specimens (pl. 5, figs. 18, 21, 22, 23, and pl. 20, fig. 32) are the most variable of all. In one lot from the Caloosahatchie river there are two specimens with the typical band-formula 12345, upper three bands dotted; four with the formula 10345, the upper band very faint, dotted, the peripheral also dotted; two without bands, and one (pl. 20, fig. 32) with faint traces of the basal bands. Mr. Hemphill found the same form in the vicinity of Charlotte Harbor, Fla., one of his specimens figured by Binney (Man. Amer. Land Shells, p. 408, fig. 449), having the formula 12345, the upper three bands broken into dots. The shell, in this form, is often more ventricose with shorter spire than in most Cuban *marielinus*, but this varies a good deal. Mr. Wright's *B. hemphilli* applies to these forms. It is the ordinary South Florida form of the species, stated to be a "thinner shell than *B. marielinus* Poey, and more corpulent, while the revolving bands are redder, finer and continuous in the last-named species; the substance of the shell of *B. marielinus* is white, while that of *B. hemphilli* is light amber colored." These supposed differences are largely due to erroneous ideas regarding *marielinus*, which is really not "white" nor has it "continuous" bands; and Cuban specimens are fully as thin as "*B. hemphilli*."

Specimens from Upper Matacumba Key, near Miami river, and Micco, vary from 12345 to 02345 or 00345, all bands generally continuous though irregular (pl. 5, figs. 22, 23). These often exceed the dimensions of the largest Haitian shells I have seen, reaching as great a size as alt. $21\frac{1}{2}$, diam. $11\frac{1}{2}$, length of aperture $10\frac{1}{2}$ mill. The shell varies from as obese as typical *dominicus* to as narrow as Binney's figure of "*marielinus*." This is what was figured by Binney as *B. marielinus*. A Cuban specimen before me has the same characters, alt. 17, diam. $8\frac{1}{2}$, length of aperture, $10\frac{1}{2}$ mill.

Still another Floridian form remains to be noticed: the bandless, oblong shells, light brown, very translucent, with indistinct corneous streaks, alt. $19\frac{1}{2}$, diam. 10, length of aperture 10 mill. (pl. 5, figs. 18, 21). The apical whorl is a little more depressed than in the typical *dominicus*. It occurs at Lake Helen, Volusia Co., and between Mosquito lagoon and the Atlantic. This local variety, which has no name, has been referred by Mr. Wright to his *B. hemphilli*, but is not mentioned in the original account of that form. Similarly col-

ored specimens were collected with typical *dominicus* on the Caloosahatchie river by C. W. Johnson.

Pfeiffer's *B. floridanus* (name pre-occupied by Conrad), was based upon slender specimens with interrupted bands. Whether the figures given by Binney (copied on my pl. 5, figs. 19, 20), are *floridanus* or not, they certainly do not represent Pfeiffer's type, as he mentions no bandless form of his species. See W. G. Binney, Terr. Moll. iv, pl. 79, f. 3; L. and Fr.-W. Sh. N. A., f. 338; Terr. Moll. v, f. 282; Man. N. A. Land Shells, f. 448; Third Suppl. to Terr. Moll. v (Bull. Mus. Comp. Zool. xix, no. 4), pl. 3, f. 7; also Wright, Nautilus iv, p. 62. The above references to Binney's work do not include his description, which is in each case an inaccurate translation of Pfeiffer's diagnosis. As the name is pre-occupied, and in all probability a pure synonym of *dominicus*, it had better be dropped.

In conclusion: Throughout its range, *D. dominicus* shows no appreciable variation in texture or sculpture; it varies in degree of inflation, the variation not being correlated with geographic location. It varies in coloration, the typical pattern occurring in Haiti, Cuba, Florida and Mexico, forms with subcontinuous bands and of larger size in Cuba and Florida, and bandless forms in Florida only, so far as known, though often associated there with banded individuals. It attains a larger size in Florida than elsewhere. All the synonyms are based upon specimens with dotted bands above.

The distribution of *D. dominicus* is enigmatic, but *D. multilineatus*, the *melanocheilus* group of *Orthalicus*, and *Cerion uva*, offer similar anomalies.

D. HJALMARSONI (Pfeiffer).

Shell subperforate, oblong-fusiform, thin, nearly smooth (seen under a strong lens to be very finely decussated), shining, diaphanous, whitish, indistinctly painted with series of spots. Spire long-conic, rather acute. Whorls 6, moderately convex, the last as long as the spire, somewhat attenuated at base. Aperture oblique, oblong-oval; peristome thin, narrowly expanded; columella thread-like, slightly arcuate, entering; the columellar margin slightly dilated above, nearly adnate.

Alt. 21, diam. 9, length of aperture 11, width $5\frac{2}{3}$ mill. (*Pfr.*).

*Pajas plantation, Manati, Porto Rico* (Hjalmarson).

*Bulimus hjalmarsoni* PFR., Malak. Bl. iii, 1856, p. 51; Monogr.

iv, p. 398.—*Bulimulus* (*Drymæus*) *hjalmarsoni* Crosse, Journ. de Conchyl. 1892, p. 23.

Apparently none but the original lot have been found. It may prove to be a form of *D. dominicus* or closely related thereto.

D. moussoni (Pfeiffer).

Shell perforate, oblong-conic, rather smooth (marked with impressed spiral obsolete lines), rather shining, white, ornamented with about 5 roseate bands. Spire conic, the apex acute, red. Whorls 6, nearly flat, the last a little shorter than the spire. Aperture oblong-oval, colored within like the outside; peristome simple, unexpanded, the columellar margin reflexed, vaulted; columella arcuate, somewhat twisted above.

Alt. 26, diam. 12, length of aperture 12, width 7 mill. (*Pfr.*).

*Yaquesi*, *San Domingo*, *Haiti* (A. Salle).

*Bulimus moussoni* Pfr., P. Z. S., 1851, p. 147; Monogr. iii, p. 423. —*Bulimulus* (*Mesembrinus*) *moussoni* Crosse, Journ. de Conchyl. 1891, p. 129.

The bands and red apex are distinguishing characters of this unfigured species, which was described from the Cuming collection.

D. bahamensis (Pfeiffer). Pl. 13, figs. 81, 82, 83, 84, 85.

Shell oblong-turreted, openly rimate, rather solid, opaque; uniform white, or marked with tawny brown streaks parallel with growth-lines, and generally interrupted by two white basal bands, and often having wider vertical purplish clouds above the periphery. Surface glossy, under the lens showing faint growth-lines and minute, close, superficial spiral incised striæ. Spire long, its lateral outlines nearly straight; apex minute, obtuse, with typical *Drymæus* sculpture. Whorls 7, slightly convex, the sutures at first hardly impressed, becoming deeper below.

Aperture decidedly less than half the total alt., ovate, rather oblique, white or faintly streaked within; peristome very slightly expanded along the outer, more along the basal margin; columella straight, slightly oblique, the margin broadly reflexed above.

Alt. 31, diam. 13, alt. of aperture 12½ mill.

Alt. 32, diam. 13, alt. of aperture 14 mill.

*New Providence*, *Bahamas* (Bland, Bendall, *et al.*).

*Bulimus bahamensis* Pfr., Malak. Bl. ix, 1862, p. 204; Monogr.

vi, p. 50; Novit. Conch. iii, p. 415, pl. 94, f. 21–24.—*Bulimulus bahamensis* BLAND & BINN., Ann. Lyc. N. H. of N. Y. x, 1871, p. 82, pl. 2, f. 3, 4 (dentition).—*Drymæus bahamensis* W. G. BINN., Ann. N. Y. Acad. of Sci. iii, p. 121, pl. xii, f. F. (jaw and dentition). —*Bulimulus* (*Drymæus*) *bahamensis* BENDALL, Proc. Malac. Soc. Lond. i, p. 293.

Bendall found it on trunks of cocoanut palms. It is closely allied to *D. immaculatus* of Jamaica, although rather more elongated and without the basal pink tint common in that species.

For Haitian references see *D. sallei* var. *haitensis*. I have not seen specimens from Durham Creek, Great Inagua (Sargent), which are on record.

D. ERUBESCENS (Pfeiffer). Pl. 13, fig. 89.

Shell perforate, oblong-turreted, thin but moderately solid, whitish-flesh or yellowish-flesh colored, *becoming pink or pinkish-brown above;* surface rather dull, smooth, showing faint growth-lines and indistinct, fine, spiral lines under the lens. Spire much elongated, apex subacute, with typical *Drymæus* sculpture. Whorls about 6, nearly flat.

Aperture less than half the length of the shell, oblique, pinkish inside, peristome thin, the outer and basal margins somewhat expanded, columella oblique, slightly twisted above, its edge reflexed above.

Alt. 29, diam. 11, length of aperture 13 mill.

Alt. 21, diam. 8, length of aperture 10 mill.

Alt. 24, diam. 10, length of aperture 12 mill.

*Jamaica.*

*Bulimus erubescens* PFR., P. Z. S., 1846, p. 112; Monogr. ii, p. 44; vi, p. 57.—REEVE, Conch. Icon., pl. 57, f. 381.

The exceptionally slender form and ruddy color of the spire are characteristic. Probably Gray's *B. rufescens* belongs here. It is known only by the following description:

*Bulimus rufescens.* Shell ovate-conic, perforate, glabrous, very minutely striated, buff-whitish; apex acute, brown; peristome simple. Length 1 inch. Jamaica (Gray, Ann. of Philos. (N. Ser.), ix, 1825, p. 414). This name is prior, but may I think fairly be held insufficiently diagnostic.

D. IMMACULATUS (C. B. Ad., Reeve). Pl. 13, figs. 86, 87, 88.

Shell perforate or nearly closed, oblong-conic, solid; opaque white, suffused with pink below, and sometimes brownish around the columella; but some shells have a delicate canary-yellow tint instead of pink. Surface somewhat glossy, showing growth-lines and fine spiral striation under the lens. Spire straightly conic, the apex slightly obtuse, $1\frac{2}{3}$ earlier whorls with typical *Drymæus* sculpture. Whorls $6\frac{1}{2}$ to 7, but slightly convex, the last tapering below.

Aperture slightly oblique, irregularly ovate; peristome simple, hardly expanded below; columella with slightly oblique, straight edge, or (in quite old specimens) strongly projecting in the middle, the reflexed margin becoming very heavily calloused with age.

Alt. 28, diam. 13, length of aperture $12\frac{1}{2}$ mill.

Alt. $32\frac{1}{2}$, diam. $13\frac{3}{4}$, length of aperture 15 mill.

Alt. 26, diam. 13, length of aperture 13 mill.

Alt. 25, diam. 11, length of aperture $11\frac{1}{3}$ mill.

*Jamaica at Mandeville* (Gloyne), *Port Maria* (Rush, Henderson), *Long Mt.* (Henderson and Simpson).

*Bulimus immaculatus* C. B. Adams MS. in Cuming collection, REEVE, Conch. Icon. pl. 85, f. 631 (Feb., 1850).—PFR., Monogr. iii, p. 411.—GLOYNE, Journ. de Conchyl. xx, 1872, p. 32.—*Bulimulus immaculatus* W. G. BINNEY, Bull. Mus. Comp. Zool. v. p. 338, pl. 1, f. D (jaw and dentition).—HENDERSON, Nautilus viii, p. 19. —*Thaumastus immaculatus* Ad., W. G. BINNEY, Ann. N. Y. Acad. Sci. iii, p. 122, pl. 12, f. H (radula).

Fresh specimens are somewhat roseate throughout, though only on the last whorl is the tint pronounced. Old cabinet specimens fade to white. In *D. liliaceus* the columella has more of a spiral twist, and so far as I know the shell is never pink tinted. The two species are very closely allied. The uniform white form of *D. bahamensis* is also excessively like some specimens of *immaculatus*. The dentition is like that of *D. bahamensis*.

D. LILIACEUS (Férussac). Pl. 13, figs. 90, 91, 92.

Shell perforate, oblong-conic, with long spire, solid; rather glossy and cretaceous; *opaque white more or less stained with bluish or with a narrow bluish streak or two.* Growth-striæ fine, the lens revealing minute spiral incised lines. Spire with nearly straight lateral outlines, the apex somewhat obtuse, with typical *Drymæus* sculpture.

Whorls $6\frac{1}{2}$ to 7, hardly convex, *the last rather swollen at and below the periphery.*

Aperture ovate, oblique, white within; peristome very slightly expanded, columella rather sinuous, the margin reflexed and pressed in above.

Alt. $33\frac{1}{2}$, diam. $14\frac{1}{2}$, length of aperture 15 mill.

Alt. 28, diam. $12\frac{1}{2}$, length of aperture $12\frac{1}{2}$ mill.

*Porto Rico: San Juan and Mayaques* (Swift); *Las Pietras and Humacao* (Blauner); *Quebradillas and Utuado* (Gundlach); *Ponce* (A. D. Brown coll.). Also reported from *Dominica* (Angas, Ramage), and *Les Cayes, Haiti* (Rolle).

*Helix* (*Cochlogena*) *liliacea* FÉR., Prodrom. p. 54, no. 401; Histoire, pl. 142 B, f. 11 (1821).—*Bulimus liliaceus* PFR., Symbolæ ad Hist. Hel. i, p. 43; Monogr. ii, p. 203.—DESHAYES, Hist, ii, p. 83. —SHUTTLW., Diagn. n. Moll., no. 6, Bern Mittheil. 1854, p. 136. —Not *B. liliaceus* REEVE, Conch. Icon. pl. 45, f. 287, nor of ANGAS, P. Z. S., 1883, p. 596.—*Bulimus* (*Leiostracus*) *liliaceus* E. A. SMITH, Ann. Mag. N. H. (6) ii, p. 230, 419.—*Bulimulus liliaceus* CROSSE, Journ de Conchyl. 1891, p. 128, 205; 1892, p. 23, 65.—STREBEL and PFEFFER, Beitr. Mex. Land und Süssw. Moll. v, p. 90, pl. 15, f. 3 a–d; pl. 16, f. 5, 6 (anatomy).—*Otostomus liliaceus* MARTENS, Jahrb. d. m. Ges., 1877, p. 350; Biol. Centr. Amer., p. 226, pl. 14, f. 19, 20.

This species was originally described from Porto Rico. It has also been reported from Haiti, St. Kitts, Dominica and Mexico. The Mexican specimens, supposed to be *liliaceus*, have been referred to *D. sulphureus* by Dr. von Martens, in my opinion correctly. That species is thinner than *liliaceus*, with the body whorl more tapering below—the base in *liliaceus* being decidedly convex, and the texture solid and cretaceous in adult specimens. Numerous specimens are before me from Porto Rico, but I have seen none from Haiti, St. Kitts or Dominica.

D. SALLEI Pilsbry, n. sp. Pl. 12, fig. 15.

Shell subperforate, ovate-conic, thin; white, delicately tinted with lemon-yellow on the spire and often on the base. Surface rather glossy, with slight growth lines and very fine, dense, engraved spiral striæ. Spire straightly conic, the apex obtuse, with very minute typical *Drymæus* sculpture. Whorls $5\frac{1}{2}$, hardly convex, the last

subangular at the periphery. Aperture ovate, oblique, slightly exceeding half the length of shell; outer lip acute, simple; columella concave below, straight above, the edge reflexed, appressed.

Alt. 16, diam. 9, length of aperture 8½ mill.

*Island of Haiti, around San Domingo and Rancho Arriba* (Salle); *around Port-au-Prince* (Parkhurst).

*Bulimus stramineus* Richard, Bland, Ann. New York Lyc. N. H. xi, p. 84, 1876.—*Bulimus stramineus* Weinland, Jahrb. D. M. Ges. vii, 1880, p. 376.—*Bulimulus stramineus* Crosse, Journ. de Conchyl., 1891, p. 127.

It is with some hesitation that I describe these shells which Bland thinks may be a variety of *D. lilaceus*, and Weinland refers to *D. stramineus;* but I am satisfied that they cannot be a variety of the former species, and the latter is widely separated geographically and presents several differential characters. The specimens before me, from the Robert Swift and A. D. Brown collections, are probably none of them quite mature.

Var. haitensis n. var. Pl. 39, fig. 4.

Shell short and rather stout, thin, somewhat translucent whitish, with 5 dark-brown spiral bands, the lowest circumumbilical, those above the periphery interrupted by occasional rather opaque, white longitudinal streaks, or even broken into squarish spots. Surface glossy, engraved with fine spirals.

Alt. 17, diam. 9½ mill. (immature).

Alt. 21, diam. 11½ mill

Alt. 16, diam. 8 mill.

*Haiti* (Bland, in A. D. Brown coll.); *Fort Jacques, near Port-au-Prince* (Linden).

*Bulimulus bahamensis* Bld., Ann. Lyc. N. H. of N. Y. xi, p. 199. —Crosse, Journ. de Conchyl., 1891, pp. 128, 206.—*Bulimus bahamensis* Weinland, Jahrb. d. mal. Ges. vii, 1880, p. 376.

The exact position and status of this form are not easily decided. It seems to be what Bland and others have referred to *bahamensis* as a variety. Some forms of *D. palpaloensis* Strebel are very similar, and the more slender forms are not unlike *D. semimaculatus* Pilsbry.

D. virginalis var. dominicanus Pilsbry. n. v. Pl. 12, fig. 24.

This Venezuelan species has already been discussed in vol. xi, p.

309. Specimens from Dominica are white, with barely 6 whorls (instead of $6\frac{1}{2}$ as in the typical form), the last subangular at the periphery in front, decidedly tapering below. Peristome with a very slightly expanded edge, the columella straight above, the reflection decidedly pressed in at its insertion. Smaller than Venezuela specimens.

Alt. 22–$22\frac{1}{2}$, diam. 10, length of aperture 10 mill.

D. STRAMINEUS (Guilding). Pl. 12, fig. 7.

Shell subperforate, ovate-conic, thin; faint straw-colored or white. Surface rather glossy, with slight growth-lines and fine spiral engraved striæ. Spire conic with nearly straight lateral outlines, the apex rather obtuse, earlier $1\frac{2}{3}$ whorls with typical *Drymæus* sculpture; last whorl somewhat tapering below, often showing a faintly indicated peripheral angle in front.

Aperture oblique, half the length of shell, ovate; outer lip thin, a trifle expanded at the edge; columella nearly straight, the edge reflexed above, appressed, leaving a mere chink at the axis.

Alt. 30, diam. $14\frac{1}{2}$, length of aperture 15 mill.

Alt. 28, diam. 15, length of aperture 14 mill.

*St. Vincent* (Guilding *et al.*); *Mustique*, *Grenadines* (Bland, H. H. Smith, Rawson); *Becquia*, *Grenadines* (H. H. Smith); *Dominica* (Sharp).

*Bulimulus stramineus* GLDG., Trans. Linn. Soc., London, xiv, p. 340 (1824); Zool. Journal, iv, p. 170.—BLAND, Ann. Lyc. N. H. N. Y. xi, 1875, p. 84.—SMITH, Proc. Malac. Soc., Lond., i, p. 304, 321, with var. *fasciata*, *op. cit.* p. 305, pl. 21, f. 9.—not *B. stramineus* CROSSE, Journ. de Conchyl. 1891, p. 127 (Haiti).—*Bulimus stramineus* PFR., Monogr. vi, p. 44; viii, p. 57.—REEVE, C. Icon. pl. 85, f. 632.—Not *Bulimus stramineus* WEINLAND, Jahrb. D. M. Ges. 1880, p. 376 (Haiti).—*Bulimus lucidus* REEVE, C. Icon. pl. 40, f. 245 (1848).—? *Bulimulus debilis* BECK, Index Moll., p. 65 (1837), based on Fér. Hist., pl. cxlii B, f. 10. See vol. XI, p. 311.

Much thinner than *D. liliaceus*, less straightly conical, and pale yellow in color, though fading in time to white.

Mr. Smith, in his article cited above, refers to a *B. lucidus* Beck; evidently an error for *B. debilis* Beck. Fresh specimens are almost of a golden yellow, but this soon fades to nearly white. Guilding writes: "It abounds in rainy weather in the underwood about Fort

Charlotte and other parts of this island, and when withdrawn into the shell resembles the pale green side of a reversed leaf, an appearance which renders it difficult to be found, and doubtless protects it from the birds." H. H. Smith found it "common locally, principally on the leeward side, in rather damp forest hillsides below 1,500 feet. In damp weather it is found on leaves or tree-trunks; conceals itself at roots of trees in dry weather."

Specimens before me from Mustique do not differ appreciably from those of St. Vincent. Examples of the shells referred to *stramineus* by Weinland and Crosse, from the Haitian localities mentioned by the latter are before me, and while very similar to the true *stramineus*, I prefer to consider them a variety or species allied to *D. liliaceus*.

Several specimens were collected by Dr. Benj. Sharp on the windward side of Dominica a few years ago, which are so similar to *D. stramineus* that I dare not call them anything else, though the island is rather separated from the well established range of the species.

Var. *fasciata* Smith. Pl. 12, fig. 8.

Like the type, but banded with purplish black or purplish red. There are usually four bands on the body-whorl—one at the middle, one-half way between it and the suture, the third equally distant below the middle, and the fourth around the umbilicus (*Smith*).

Leeward side of St. Vincent, in dry forest below 1,000 feet, on leaves in wet weather, or at roots of trees and in crevices of rocks in dry weather. The animal is green like the allied (typical) form, and this is probably a variety, but it is found in much dryer situations, principally on the ridges between Cumberland and Largon. Rarely the two forms are associated; nowhere common (*H. H. Smith*).

D. MULTIFASCIATUS (Lamarck). Pl. 13, figs. 93, 95, 96, 97.

Shell perforate, oblong-conic, thin; *white or yellowish, with five dark purple-brown bands*, the uppermost narrow and sutural, the second about midway between suture and periphery, the third wider, just above the periphery, the space between these two crimson, or occasionally the two widen and coalesce; fourth band the widest; fifth a mere crescent around the perforation, the space between bands iv and v crimson. Surface glossy, with fine growth-lines and minute,

crowded, spiral incised lines. Spire rather long, somewhat slender, the apex somewhat obtuse, with typical *Drymæus* sculpture, *several earlier whorls black or blackish.* Whorls about 6, somewhat convex, the sutures rather impressed, defined by a white line.

Aperture short ovate, rather oblique, banded within; outer lip thin, a trifle expanded; columella somewhat concave, its edge reflexed above and impressed at the insertion; the peristome not angular at juncture of columellar with basal margins.

Alt. 25, diam. 12, length of aperture 10½ mill.

Alt. 23, diam. 12, length of aperture 10 mill.

*Martinique, at Fort de France, and Massif des Pitons,* living mainly between 100 and 150 meters alt., on leaves of trees. *Guadeloupe,* numerous localities between 375 and 610 meters above the sea (Maze). *Dominica* (Angas, Brown, Ramage).

*Bulimus multifasciatus* Lamarck, An. s. Vert. vi, p. 123 (1819); Edit. Desh. viii, p. 233.—Delessert, Recueil, pl. 28, f. 3.—Reeve, Conch. Icon. pl. 46, f. 295.—Pfr., Monogr. ii, p. 108; iii, 343; iv, 406; vi, 52; vii, 66; Conchyl. Cab. p. 239, pl. 63, f. 11, 12.—*Bulimus* (*Leiostracus*) *multifasciatus* E. A. Smith, Ann. Mag. N. H. (6), ii, p. 230, 419.—*Bulimulus multifasciatus* Beck, Index, p. 65.—Maze, Jour. de Conchyl. 1874, p. 163, with var. *albicans;* also 1883, p. 16.

? *Liostracus multifasciatus* Ffld., Verh. Zool. bot. Ges. Wien, xix, 1869, p. 874.

*Helix* (*Cochlogena*) *picturata* Fér., Prodr. p. 54, no. 400.—*Bulimus picturatus* Pot. and Mich., Galerie, i, p. 147 (1838).

The crimson zones between bands ii and iii, and iv and v remind one of some forms of *D. pœcilus* Orb. In some Martinique shells bands ii and iii are coalescent, and this is perhaps invariable in Dominica specimens.

Besides the localities recorded above, the species has been reported from Trinidad, Cayenne and La Guayra. The continental localities are so doubtful and ill-attested that I wholly discredit them. Lamarck's types probably come from Martinique, as they agree perfectly with specimens from that island.

The Guadeloupe form, according to Mazé, is quite different from that of Martinique, and is distinguished by a thin, fragile shell, of a beautiful light golden-yellow, with numerous transverse bands of violaceous brown on the last three whorls. Whorls 6½. Some specimens

measure alt. 33. diam. 14, length of aperture 16 mill.; the ordinary size of the species being, alt. 25, diam. 12, length of aperture 12 mill.

Of Dominica specimens collected by Ramage, Smith writes: "Three specimens from Dominica are very different in colouring from the type as figured by Delessert (Recueil, pl. xxvii, fig. 3). They are of a warm reddish-pink color, banded with purple-black. The upper whorls exhibit two bands, one just beneath the suture and the other, a trifle broader, rather below the middle. The body-whorl has a third zone beneath the centre somewhat narrower than the one above it. The fine spiral striæ correspond with those of the typical form, and the minute pitting of the dark apical whorls is the same."

Var: *albicans* Maze. Shell entirely white except the earlier three whorls, which show faintly three brown bands.

*St. Pierre*, *Martinique*, at 200 meters alt.

Var. *christopheri* Pilsbry, n. v. Pl. 13, figs. 98, 99.

Similar to *D. multifasciatus* in texture and sculpture, but without pink markings, the fourth band with a light-brown border above, the same tint also appearing around the fifth band and sometimes above the third; spire stouter, with somewhat convex lateral outlines; *aperture longer, less rounded; umbilicus more open.*

Alt. 25, diam. 12½, length of aperture 12½ mill.

*St. Christopher* (Swift, Bland).

There is also a clear lemon-yellow tinted whitish form of this variety, agreeing with the banded specimens in contour. Bland has already reported it from St. Christopher under the name *Bulimus multifasciatus.*

W. G. Binney has described the jaw and radula of a shell from Antigua, which he refers to *Liostracus multifasciatus* (Ann. N. Y. Acad. Sci. iii, p. 121).

D. LATICINCTUS (Guppy). Pl. 13, fig. 94.

Shell perforate, conic-elongate, thin, fuscous or yellow, shining, decussate, zoned by four dark chestnut bands, of which two are visible on the upper whorls, the second (reckoning from the suture) being the widest. Whorls 6, a little convex, regularly increasing, the last about two-thirds the length of the shell; spire elongate, the apex acuminate. Aperture semi-oval; peristome simple, acute, hardly expanded; columellar margin reflected over the narrow perforation; columella slightly twisted.

Alt. 24, diam. 10, length of aperture 10, width 5 mill. (*Guppy.*)

*Var.:* like the type, but yellowish or greenish, devoid of color-bands, and somewhat broader.

*Dominica* (Guppy, Ramage, G. E. & A. H. Verrill).

*Bulimulus laticinctus* Guppy, Ann. Mag. N. H. (4), i, 1868, p. 431.—Bland & Binn., Ann. Lyc. N. Y. x, 1871, p. 81, pl. 2, f. 1, 5 (dentition).—Pilsbry, Trans. Conn. Acad. viii, p. 356.—*Bulimus* (*Leiostracus*) *laticinctus* E. A. Smith, Ann. Mag. N. H. (6), ii, p. 230.—*Mormus laticinctus* W. G. Binney, Ann. N. Y. Acad. Sci. iii, p. 122, pl. 12, f. I (radula).

More slender and elongated than *D. multifasciatus*, but similar in texture and sculpture. The broad second band may be regarded as formed by the coalescence of bands ii and iii of a 5-banded parent stock.

D. vincentinus (Pfeiffer). Pl. 13, figs. 1–7.

Shell subperforate, fusiform, thin; white or faintly yellow tinted, unicolored or with five chestnut or bluish-brown spiral bands, usually subequal in width, and equidistant, or with the upper and lower intervals slightly wider. Surface glossy, showing fine growth-lines and minute engraved spiral striæ; spire conic, the apex rather obtuse, with typical *Drymæus* sculpture, and usually reddish or blackish in banded specimens. Whorls 6, slightly convex, the last tapering below the periphery.

Aperture oblong, *decidedly oblique, the length usually exceeding twice the width* (measured inside), yellow tinted or showing bands within; peristome thin, the lower part of the *outer, and the basal margin well expanded;* columella with convex inner edge, *obliquely truncated at base* (figs. 4, 6), with no perceptible fold above; the margin triangularly reflexed above, nearly closing the perforation.

Alt. 30, diam. 12, length of aperture 15 mill.

Alt. 26½, diam. 12, length of aperture 13½ mill.

*Trinidad* (Guppy and others); *Tobago* (Dr. B. Sharp); *St. Vincent* (Pfr.).

*Bulimus vincentinus* Pfr., P. Z. S. 1846, p. 30; Monogr. ii, p. 103; iii, 338; iv, 397; vi, 44; viii, 56.—Reeve, Conch. Icon. pl. 55, f. 366.—Bland, Amer. Jour. Conch. iv, p. 182.—*Bulimulus vincentinus* Crosse, Journ. de Conchyl. 1890, p. 42.—Guppy, Journ. of Conch. vii, p. 219 (1893).—*Bulimulus vincentinus Pfr.*,

*var.?* W. G. Binney, Proc. Acad. N. S., Phila., 1874, p. 53 (jaw and dentition).—*Bulimulus* (*Drymæus*) *vincentinus* Pfr., E. A. Smith, Journ. of Conch. viii, p. 244 (Oct. 1896); Proc. Malac. Soc. Lond. i, p. 305.—*Drymæus vincentinus* Pfr., var. W. G. Binney, Ann. N. Y. Acad. Sci. iii, p. 120 (jaw and radula of Tobago specimens).—*Bulimulus multifasciatus* Lam., Guppy, Proc. Scient. Asso. Trinidad, 1866, p. 17; Ann. Mag. N. H. (3), xvii, 1866, p. 49 (exclusive of var. *imperfectus*).—*Bulimus immaculatus* C. B. Ad., Guppy, l. c. p. 49, not of C. B. Adams.

The long, narrow, oblique aperture, decidedly expanded lip, effuse at base, and the abrupt backward bend of the columella below, are characteristic.

Some specimens show a varix or two, caused by continuation of growth after an expanded peristome had been formed. Like many allied species, two forms occur: a five-banded, the typical *vincentinus* of Pfeiffer, and a bandless, yellowish-white, which may be known as form *purissimus*. Bland writes of the experiences of Gill and Guppy as follows: "The banded form lives on trees and is found throughout the colony, being perhaps more common at Monos Island. The yellowish-white, bandless variety is found on the tops of trees in the forests over a great part of the island. It is very abundant in some localities, particularly in some gardens at Port-of-Spain."

Pfeiffer gave the locality St. Vincent, upon whose authority does not appear. It has not been found there by several naturalists who have collected land snails on the island, and there is ground for Bland's belief that it does not occur. *D. vincentinus* has also been reported from the mainland in Venezuela. This too requires confirmation. The Tobago form (figs. 5, 6, 7) is rather smaller and more slender than that from Trinidad, and the bands, when present, are wider. Binney examined the radula of a specimen from this island.

Var. *flavotinctus* Pilsbry, n. v. Pl. 12, fig. 11.

Shorter, more ovate, the spire short, whorls hardly 6, almost flat, the sutures not impressed. Aperture very large; lip broadly expanded below. Glossy, white, with the three earlier whorls and a basal patch pale yellow.

Alt. 28, diam. 14, length of aperture nearly 16 mill.

*Trinidad.*

Somewhat like *D. eurystomus* Phil.

D. IMPERFECTUS (Guppy). Pl. 12, figs. 1, 2, 14.

Shell narrowly perforate, oblong conic, thin; milk-white, translucent below the periphery and on the spire, with five chestnut bands, the second (from above) usually narrowest, the fourth widest, apical two whorls red-brown. Surface very glossy, under a strong lens showing delicate growth-lines and minute engraved spiral striæ. Spire straightly conic, the apex rather obtuse. Whorls $5\frac{1}{2}$, nearly flat, the earlier $1\frac{1}{2}$ convex, with typical *Drymæus* sculpture, the last whorl perceptibly angular at the periphery in front.

Aperture less than half the shell's length, oblique, ovate; outer lip thin, unexpanded, white-edged, the bands not continued quite to the edge; columella slightly concave, triangularly reflexed above.

Alt. 15, diam. $7\frac{1}{2}$, length of aperture 7 mill.

Alt. 14, diam. 7, length of aperture $6\frac{1}{2}$ mill.

*Southern part of Trinidad* (Guppy).

*Bulimus multifasciatus var. imperfectus* GUPPY, Ann. Mag. N. H. (3), xvii, 1866, p. 49; BLAND, Amer. Jour. of Conch. iv, 1868, p. 184.—*B. aureolus var. imperfectus* GUPPY, Amer. Jour. of Conch. vi, p. 308; Jour. of Conch. vii, 1893, p. 219.—*Bulimulus* (*Drymæus*) *trinitarius* E. A. SMITH, Jour. of Conch. viii, p. 242, pl. 8, f. 7, 7a (1896).—? *Bulimulus aureolus* var. *fasciatus* GUPPY, Amer. Journ. Conch. vi, p. 184.

With the band pattern of *D. vincentinus*, this shell is smaller and has an aperture and lip of very different form. Description and figure 14 are from specimens received from Mr. Guppy. The series of seven before me shows but slight variations.

Mr. E. A. Smith has described the same species as *B. trinitarius* (figs. 1, 2), apparently overlooking Mr. Guppy's good diagnosis of *imperfectus* published thirty years previously. His specimens are a little larger than those before me, alt. 19, diam. 9, length of aperture 9 mill., with 6 whorls, and the lip is described as somewhat expanded in front.

It is allied to *D. rufolineatus* Drouet, but differs somewhat in form and banding.

D. AUREOLUS (Guppy). Pl. 12, fig. 3.

Shell subperforate, ovate-conic, rather acuminate, thin, yellow, shining, translucid; finely striated by minute and close longitudinal lines of growth, crossed by finer decussating striæ. Whorls 5 to 6,

or in large specimens $6\frac{1}{2}$ to 7, scarcely convex, except the last, which is somewhat carinate. Aperture ovate; peristome acute, slightly effuse.

Alt. 25, breadth 10, length of aperture 10 mill. (*Guppy.*)

*Savana Grande*, *Trinidad*, on trees (Guppy).

*Bulimus aureolus* GUPPY, Ann. Mag. N. H. (3), xvii, 1866, p. 49. —BLD., Amer. Jour. of Conch. iv, p. 184.—PFR., Monogr., p. 148. —*Bulimulus aureolus* GUPPY, Amer. Jour. Conch. vi, p. 307 (exclusive of varieties *fasciatus*, *imperfectus* and *rawsoni*); Jour. of Conch. vii, p. 218 (exclusive of same varieties); Jour. of Conch. i, p. 109.—CROSSE, Journ. de Conchyl., 1870, p. 42.—*Bulimulus* (*Drymæus*) *aureolus* SMITH, Journ. of Conch. viii, p. 241, pl. 8, f. 6.

D. RAWSONI (Guppy). Pl. 12, fig. 6.

Shell narrowly perforate, oblong-conic, rather thin, glossy, *milk white, with the apex and a small area around the columella buff.* Growth striæ fine and faint, decussated by minute engraved spiral striæ. Spire conic, the apex rather obtuse, showing typical *Drymæus* sculpture. Whorls about 6, slightly convex, the last subangular in front in young, and slightly so in most adult individuals; tapering below.

Aperture slightly oblique, oblong, narrowed toward the ends and acuminate above, white inside; peristome thin, simple, the outer lip slightly sinuous, basal lip a trifle expanded, columella straight, obliquely truncated below, the profile view showing a projecting angle as in *D. vincentinus;* margin reflexed above.

Alt. 24, diam. 11, length of aperture 11–$11\frac{1}{2}$ mill.

*Island of Tobago* (Rawson).

*Bulimulus aureolus* var. *rawsoni* GUPPY, Amer. Journ. of Conch. vi, 1871, p. 308, pl. 17, f. 6.—*Bulimus* (*Drymæus*) *rawsonis* H. ADAMS, P. Z. S., 1873, p. 208, pl. 23, f. 12.—PFR., Monogr. viii, p. 151.—*Bulimulus* (*Drymæus*) *rawsoni* H. Ad., SMITH, Journ. of Conch. viii, p. 242.—*Drymæus rawsonis* W. G. BINNEY, Ann. N. Y. Acad. Sci. iii, p. 121 (radula).

Milk white, with yellow apex and columellar streak; the aperture decidedly less than half the total length, shaped much as in *D. vincentinus* except that the peristome is not expanded. Mr. Smith includes it in his Trinidad list, but I know of no record of its occurrence outside of Tobago.

D. MOSSI (E. A. Smith). Pl. 12, fig. 4; pl. 39, fig. 6.

Shell elongate, rimate; white, yellowish at the apex and around the base; spire acuminate; whorls 5 to 6, the upper two embryonic whorls punctate-reticulate, a little convex, the rest less convex, separated by slightly oblique sutures, edged below the suture by a very narrow opaque white line; sculptured with very delicate oblique growth-lines and somewhat waved, extremely fine spiral lines; last whorl elongated. Aperture reversed ear-shaped, exceeding half the total altitude of the shell; outer lip thin, a little expanded anteriorly; columella thin, reflexed over the narrow perforation. Alt. 21½, diam. 9½, length of aperture 12, width 6⅓ mill. (*Smith.*)

*Trinidad* (W. E. Broadway).

*Bulimulus* (*Drymæus*) *mossi* SMITH, Journ. of Conch. viii, no. 8, p. 243, pl. 8, f. 8 (Oct. 1, 1896).

In color this species resembles *B. Rawsoni* of H. Adams. It differs from that species, however, in form, the more effuse outer lip, and the more narrowly reflexed columella. In *B. Rawsoni* the spire is longer and the aperture shorter than in this species, and the relative proportions are quite different. The single specimen examined has been kindly submitted to me for examination by Mr. W. Moss, after whom I have the pleasure of naming the species. (*Smith.*)

D. BINOMINIS (Smith). Pl. 12, fig. 9.

Shell subperforate, somewhat thin, oblong-conic, rather ventricose, pale reddish-brown or inclining to yellowish-white. Whorls 6, gradually increasing, the last somewhat ventricose, equal to two-thirds of the length of the shell. Spire conic, sharp. Aperture oblong-oval; peristome acute, not expanded; columellar margin reflexed over the narrow umbilicus. Dimensions of a typical example, alt. 23, diam. 12, length of aperture 11, width 6 mill. (*Guppy.*)

*Island of Grenada*, shady places, 500–1500 feet alt., on trees; rather rare (H. H. Smith).

*Bulimulus indistinctus* GUPPY, Ann. Mag. Nat. Hist. (4), i, p. 436 (June, 1868).—BLAND, Amer. Jour. Conch, iv, p. 188.—*Bulimus indistinctus* Guppy, PFR., Monogr. viii, p. 184. Not *B. indistinctus* Pfr. 1852.—*Bulimulus* (*Drymæus*) *binominis* E. A. SMITH, Proc. Malac. Soc. London, i, p. 316, pl. 21, f. 13 and f. 14, var. *lascellesiana.*

Var. *lascellesiana* Smith. Pl. 12, fig. 10.

Of a very dark, almost black, tint, with two narrow yellowish or whitish transverse zones on the penultimate whorl, and four on the last. The edge of the peristome is also whitish. The third zone from the suture is the broadest, and the fourth or basal one is sometimes somewhat indistinct (*Smith*). It is, I believe, only found on the Annandale estate, and only on one small part of that—a strip of land facing west on a rocky mountain side, at an elevation of 1,000 to 1,200 feet (*Lascelles*).

Mr. Smith's figure shows five bands upon the last whorl.

D. BROADWAYI (E. A. Smith). Pl. 12, fig. 5.

Shell short, ovate, slightly rimate, thin, subpellucid, whitish-corneous with a brown band at the suture. Spire short, conic, rather obtuse and blackish at the apex. Whorls 5, somewhat rapidly increasing, a little convex, earlier two minutely punctate cancellate, the following a little shining, striated with delicate growth-lines; last whorl slightly globose, having slender, oblique, more or less numerous riblets. Aperture a little exceeding half the total altitude of the shell; peristome very thin; columellar margin slightly thickened, thinly and narrowly reflexed.

Alt. 14, diam. 8½, length of aperture 8, width 6 mill. (*Smith*).

*Trinidad* (W. E. Broadway).

*Bulimulus* (*Drymæus*) *broadwayi* SMITH, Journ. of Conch. viii, p. 243, pl. 8, f. 9 (Oct. 1, 1896).

Mr. Moss informs me that this very interesting addition to the fauna was discovered by Mr. W. E. Broadway, who at that time was an assistant in the Botanic Gardens, Trinidad. We are also indebted to him for the discovery of the preceding species (*D. mossi*). Mr. Moss, who has received from him a fine series of the Trinidad shells, has liberally placed one of his three specimens of this species in the British Museum collection. It is very different from all the other indigenous forms, and quite distinct from any of the continental species. The fine rib-like lines of growth on the body-whorl are peculiar, and the style of coloration is very remarkable. I have much pleasure in naming this very interesting form after Mr. Broadway (*Smith*).

D. UNDULATUS (Guilding). Pl. 13, figs. 77, 78, 79, 80.

Shell perforate and openly rimate, ovate-conic, moderately solid;

white or yellowish with *numerous purple-brown longitudinal undulating stripes* which are widened at intervals, forming on the body-whorl four spiral bands of spots, sometimes in part coalescent spirally, three on the spire, *leaving the umbilical area and a band along the outside of the lip light;* markings absent on the earlier whorls. Spire conic, apex rather obtuse, white, with typical *Drymæus* sculpture. Whorls about 6, slightly convex, the last not descending.

Aperture *vertical*, elliptical, narrowed above and below, maculated inside, one-half the length of the shell; peristome rather broadly bordered with white, moderately expanded, the columellar lip dilated, columella slightly concave, with a faint fold above.

Alt. 28, diam. 13½; alt. of aperture 14 mill.

Alt. 34, diam. 14; alt. of aperture 17 mill.

*St. Vincent, on a mountain ridge between Mt. St. Andrews and the Grand Bonhomme*, about 2000 ft. alt., damp forest, generally on the leaves of palm trees (H. H. Smith).

*Bulimulus undulatus* GUILDING, Zool. Journal iv, p 169.—*Bulinus undulatus* SOWB., Conch Illustr, f. 54.—*Bulimus undulatus* REEVE, Conch. Icon. pl. 40, f. 247.—PFR., Monogr. ii, p. 95; iii, 374; iv, 444; vi, 80; viii, 112; Conchyl. Cab. p. 167, pl. 50, f. 7. —*Bulimus* (*Plecochilus*) *undulatus* E. A. SMITH, Proc. Malac. Soc. i, p. 306. Not *Plekocheilus undulatus* GLDG., see vol. x, p. 65.—*Bulimulus fluctuatus* BECK, Index, p. 66.

This species has the color-pattern of a typical *Drymæus*, though with the lip less expanded than usual. The pattern of scalloped streaks is broken into spots on the spire, in the usual and typical form. Figs. 79, 80, copied from Pfeiffer, represent a variety or form with quite modified color-pattern.

Beck has named three varieties: *exalbidus*, *subfasciatus* and *lituratus;* the latter only is defined by a reference to Sowerby's Conch. Illustr. f. 54. This figure is somewhat more slender than my fig. 77, but has no claims to varietal distinction so far as I can see.

D. ELONGATUS (Bolten). Pl. 11, figs. 1–26.

Shell oblong-conic, perforate or closed, solid and strong. White, yellowish or red, unicolored or variously banded or streaked with chestnut, chocolate or purplish-brown. Shining, smoothish, with slight growth-lines and generally minute, sub-obsolete spiral striation. Spire straightly conic, long, apex rather obtuse. Whorls about 6½, but slightly convex.

Aperture ovate, ochre, red or brown inside, slightly oblique, generally less than half the shell's length; outer lip thickened within, a trifle expanded at the edge; columella subvertical, generally brown, often white.

Alt. 30, diam. 13½, alt. aperture 15 mill. (Porto Rico.)
Alt. 30, diam. 12, alt. aperture 13 mill. (Porto Rico.)
Alt. 26, diam. 12½, alt. aperture 14 mill. (Porto Rico.)
Alt. 27½, diam. 14, alt. aperture 14 mill. (Anageda.)
Alt. 27, diam. 12½, alt. aperture 12 mill. (Anageda.)
Alt. 26, diam. 11½, alt. aperture 11½ mill. (S. Eustatius.)
Alt. 31, diam. 13½, alt. aperture 15 mill. (*extinctus.*)
Alt. 23, diam. 9½, alt. aperture 10 mill. (S. Croix.)
Alt. 33, diam. 14½, alt. aperture 15 mill. (S. Croix.)

*Porto Rico, Virgin Is. and Northern Caribbean Is., Curaçao and Bonaire. Porto Rico: Fajardo and Ceibo* (Blauner); *Manati, Arecibo, Quebradillas Guanica, Utuado* (Gundlach); *Penuelas* (Sintensis) *San Juan* (Swift). *Vieque* (Blauner, Swift). *Anageda* (Cleve). *Tortola* (Swift). *St. Thomas* (Bland, "hills about Baker's," Swift). *St. John* (Bland, Swift). *St. Croix, Recovery Hill* (Riise). *St. Martins, on the mountains* (Swift); *Simson Bay* (Kohlmann, Van Rijersma). *St. Bartholomew* (Dr. Cleve). *St. Eustatius* (F. Ober, John E. Hill). *Antigua* (Rev. A. Hamilton). *Gaudeloupe* (Beau, Schramm, Bland). *Bonaire* (Bland). *Oruba* (Hartert). *Curaçao* (Raven). Doubtful localities: *Martinique* (Bld. in coll. A. N. S.). *Caracas, Venezuela* (Ernst).

*Typical Form.*

*Helix elongata* Bolten, Mus. Boltenianum, p. 107, no. 1371, based upon Chemnitz, ix, pl. 134, f. 1225*a* (1798).—*Bulimus elongatus* Bolt., Pfr., Monogr. iv, p. 482; vi, 128; viii, 165.—*Bulimulus elongatus* E. A. Smith, Proc. Malac. Soc. Lond. iii, p. 113.—*Helix* (*Cochlogena*) *virgulata* Férussac, Tabl. Syst., p. 54, no. 396 (1822); Histoire, pl. 142 B, f. 1–7.—*Bulimus virgulatus* Menke, Syn., edit. 2, p. 27.—Pot. & Mich., Galerie i, p. 132, pl. 12, f. 7, 8 (young).—Pfeiffer, Monogr. ii, p. 202; iii, 421; Conchol. Cab., p. 161, pl. 46, f. 9, 10.—Desh. in Fér., Hist. ii, p. 91, pl. 150, f. 7, 8.—Reeve, Conch. Icon., pl. 49, f. 320.—Shuttleworth, Diagnosen neuer Moll., no. 6, Bern Mittheil., 1854, p. 136.—Bland in Adams' Contrib. to Conch., no. 11, p. 220 (1852).—*Bulimulus vir-*

*gulatus* MAZE, Journ. de Conchyl., 1883, p. 18; 1890, p. 25.—CROSSE, Journ. de Conchyl., 1892, p. 24, 62, 66, 67.—MARTENS, Jahrb. D. Mal. Ges. iv, 1877, p. 350; Nachrbl., 1891, p. 132.—SEMPER, Reisen im Archip. Phil., Landmoll., p. 153, pl. xv, f. 4 (genitalia), pl. xvii, fig. 6 (teeth).—*Otostomus virgulatus* MARTENS, Binnenmoll. Venez., p. 184 (28).—*Helix detrita* Müll., CHEMNITZ, Conchyl. Cab. ix, p. 161, pl. 134, f. 1225 a, b. (not of Müller).—*Helix exilis* γ GMEL., Syst. Nat. (13), p. 3669.—*Bulimus caribæorum* LAM., Anim. s. Vert. vi, pl. 2, p. 124 (1822); Edit. DESH., viii, p. 233.—*Bulimulus caraibœorum* BECK, Index, p. 66.

*Fossil form.*

*Bulimus extinctus* PFR., Malak. Bl. ii, 1855, p. 103, pl. 4, f. 9, 10; Monogr. iv, p. 470.—*Bulimulus extinctus* BLD., Ann. N. Y. Acad. Sci. ii, p. 122.

*Blue tipped form.*

*Bulimus apiculatus* GRAY, P. Z. S. 1834, p. 66.—PFR., Monogr. ii, p. 209.—*Bulimus kämmereri* MÖRCH, Catal. Conch. Yoldi, p. 23 (1852); no description.—*B. virgulatus* var., PFEIFFER, Monogr. iii, p. 421 (1853), referring to Conchyl. Cab. pl. 46, f. 11, 12.

*Red color-variety.*

*Bulimulus proteus* GUILDING, in Swains., Malacology, p. 335 (nude name) *cf.* PFR., Monogr. ii, 202.—*Helix ludovica* RANG, in Paris mus. (*fide* Pfr., Monogr. ii, p. 202.).—*Bulimus elongatus* var. *rubra* Pfr., Monogr. iv, p. 482.—*Bulimulus virgulatus* var. *carnea* MORCH, Catal. Yoldi, p. 23 (nude name).

*Variety anguillensis.*

*Bulimus anguillensis* PFR., Malak. Bl. xii, 1865, p. 123; Novit. Conch. fasc. 23, p. 281, pl. 69, f. 3–6; Monogr. vi, p. 146.

This is one of the most variable species of the genus. The color-varieties may be arranged as follows:

1. Uniform white, the columella generally brown stained, and interior of aperture olive or brown. Apex generally white, often blue (fig. 5).

1 *a*. White or whitish, with three or four spiral bands of chestnut or purplish, either continuous or interrupted (fig. 6).

1 *b*. White or whitish, with many narrow longitudinal streaks, no

bands. This is the typical color-form of the species, historically (figs. 3, 8).

1 *c*. The same, but streaks coalescent.

2. Flesh, salmon or scarlet red, paler above. (Form *ludovica* 'Rang' Pfr., pl. 11, fig. 16).

2 *a*. Red or reddish, with three spiral bands, subcontinuous or interrupted into spots (figs. 15, 17).

2 *b*. Red or reddish, with longitudinal streaks, no bands (fig. 13).

3. Dirty white, with blue apex and wide spiral zones composed of vertical lines or streaks. (Form *apiculatus* Gray, pl. 11, figs. 4, 12.)

4. Fossil in St. Croix; rather slender with pyramidal spire of flat whorls (form *extinctus* Pfr., pl. 11, f. 24–26.)

5. Small, rather slender, bands when present purplish, "distinguished from all forms of *elongatus* by the much more lengthened contour, narrow aperture and lip-like internal thickening of the peristome" (Form *anguillensis* Pfr., pl. 11, f. 20–23.)

None of the patterns of coloring seem to be constant or sharply restricted geographically, although frequently the specimens from one special locality are alike. Thus of 34 specimens from Porto Rico there are 7 uniform white, 5 red, 2 red with bands, 5 whitish with interrupted bands, 10 with narrow streaks, and the rest various transitions. In Tortola the various forms with red ground color predominate, but forms 1, 1*b* and 1*c* also occur. In a series of 27 from Curacao there are 6 red, 3 red with bands, 2 white, 15 white with bands or spots (some with the apex blue), and 1 white with streaks.

While I have above given the names applied to various forms, I do not regard them as of subspecific value; my conclusions being based upon a series of some hundreds of shells covering every island mentioned in the above paragraph of geographic distribution.

*B. extinctus* Pfr. (pl. 11, figs. 24–26), originally described from one specimen, is shown by my series to be absolutely equivalent to *elongatus* (*virgulatus*), numerous specimens intergrading perfectly. It is from Pleistocene deposits of St. Croix.

*B. anguillensis* Pfr. (pl. 11, figs. 20–23), is typically rather small, slender and pale colored. It also intergrades with *virgulatus* through the form *apiculatus* Gray (*kämmereri* Mörch). Typical *anguillensis* is from Anguilla, but a series of twenty shells from St. Croix (pl. 11, figs. 18, 19) exactly correspond in form and color, but are thinner, with the lip hardly thickened; these being the thinnest specimens of

the species I have seen. Some of the St. Martin and St. Barts examples might also be called "*anguillensis*." It seems to be an ill-defined or incipient subspecies.

Red forms, both plain and banded, occur on Porto Rico (rare), Tortola, Bonaire and Curaçao; also Guadaloupe and Martinique. It is possible that the specimens from the latter two islands are an importation. If so, the anomaly of the occurrence of *virgulatus* in Curaçao is even more accentuated; but that island has also a species of *Cerion*, a genus not occurring in the Caribbees, but common on the Virgin Islands.

Figs. 1–4 are from Porto Rico shells; 5, 6, Anageda; 7, 8, St. Thomas; 12, St. Eustatius; 13–17, Tortola; 18, 19, St. Croix; 20–23, Anguilla; 24–26, St. Croix.

D. MULTILINEATUS (Say). Pl. 11, figs. 27–33.

Shell narrowly perforate, oblong-pyramidal, solid; *opaque white, faintly blue- or brown-tinted, becoming purplish-blue on the earlier whorls, irregularly obliquely streaked with chestnut, having a blackish chestnut band below the suture and an umbilical patch of the same*, usually with a basal band also, and often another narrow one a short distance below the sutural band. Surface slightly shining, densely but rather obsoletely striated spirally. Spire long, straightly conic, the apex rather obtuse. Whorls 7, rather convex, the last decidedly so.

Aperture oblique, oblong-ovate, streaked within, its length contained nearly or quite $2\frac{1}{2}$ times in that of the shell; peristome simple, broadly dark-bordered inside and out; columella concave, dilated and sub-appressed above.

Alt. 25, diam. 10.8; alt. of aperture 10 mill.

Alt. 24, diam. 10.5; alt. of aperture 10.2 mill.

*Florida: Key West, Bahia Honda Key and Lower Matacumba Key; north to Marco. Yucatan: Sisal* (Morelet). *Colombia: Santa Marta, Magdalena, Bambo Bay and Barranquilla* (Swift, Bland), *Savanilla and Carthagena* (Gibbons). *Venezuela: Maracaibo and Puerto Cabello* (Swift), *Valencia* (Simon), *Augostura or Ciudad Bolivar* (Gruner, Swift). *Island of Curaçao* (Swift, Gibbons).

*Bulimus multilineatus* SAY, Journ. Acad. Phil. v, p. 120 (1825). —PFR. Monogr. Helic. Vivent. ii, p. 204.—*Mesembrinus multilineatus* TRYON, Am. Journ. Conch. iii, p. 169, pl. 9 (13), fig. 11, 12.—

*Bulimulus* (*Mesembrinus*) *multilineatus* BINNEY & BLAND, Land and Fresh-water Shells of N. A., i, p. 197, fig. 344.—FISCH. & CROSSE, Miss. Scient. Mex., Mollusca, i, p. 545.—*Bulimulus multilineatus* BINNEY, Terr. air-breath. Moll. of N. A. v, p. 395; Manual of Am. Land-Shells, p. 404, fig. 443.—DALL, Proc. U. S. Nat. Mus. 1885, p. 260.—GIBBONS, Journ. of Conch. (Leeds), ii, p. 136.—*Bulimus menkei*, GRUNER in Wiegm. Arch. f. Naturg. 1841, p. 277, pl. 11, fig. 2.—PFR. Monogr. Helic. Vivent. ii, p. 176; Martini & Chemnitz, Syst. Conch.-Cab. ed. 2, *Bulimus*, p. 190, pl. 49, figs. 19, 20.—*Bulimus* (*Mesembrinus*) *menkei* ALBERS, Die Helic, ed. I, p. 157.—PFR. in Malak. Blätt. ii, p. 158 (1855).—*Bulimulus* (*Mesembrinus*) *menkei*, VON MART. in Albers' Die Helic. ed. 2, p. 214.—*Otostomus* (*Mesembrinus*) *menkei*, MART., Binnenmoll. Venezuela's p. 28; Biol. Centr. Amer. Moll., p. 235.—*Mesembrinus menkei* JOUSS., Mém. Soc. Zool. France, ii, p. 241.—*Bulimus sisalensis* MORELET, Test. Noviss. i, p. 9 (1849), ii, p. 27.—*Bulimus venosus* REEVE, Conch. Icon. v, *Bulimus*, pl. 45, fig. 285.—*Bulimus virgulatus* (Férussac), LEIDY, in Binney's Terr. air-breath. Moll. of N. A. i, p. 259, pl. 15, figs. 7, 8 (anatomy).—BINNEY, op. cit. ii, p. 278, pl. 58.—*Bulimus parvus* LEA, Trans. Amer. Philos. Soc. vi, p. 84, pl. 23, f. 96 (June, 1838); Obs. Gen. Unio, ii, p. 84, pl. 23, f. 96.

The geographic range of this species is remarkably discontinuous, but with large series before me from Venezuela, Colombia and Florida, I am compelled to agree with von Martens and others that no specific separation is possible. There are, however, one or two incipient subspecies in South America. These are too ill-defined to deserve names, but as the tendency toward differentiation exists, I have below used the names already given. The South American forms are doubtless the parent stock, and the Floridian probably a colony introduced by some "accidental" or rarely efficient agency.

The typical Floridian form always has the earlier whorls dark blue with a light subsutural border, and the color-pattern of the whole shell is well developed. Some South American shells (form *menkei* Gruner, pl. 11, fig. 33) also show these characteristics; but the majority have the earlier portion of the spire white or rose-tinted, and very frequently the color-pattern throughout is weaker, spiral bands absent (fig. 31) or all the streaks lost except a few on the latter part of the last whorl (fig. 30, Yaracui, Venezuela).

The shells from Curaçao often lack the subsutural and umbilical markings, and show traces of a peripheral band (fig. 32), but occasionally lack all spiral bands; the apex generally white. They are readily distinguishable from *D. elongatus* Bolt., which occurs on the same island, the only locality to my knowledge where the two are associated.

Form *parvus* Lea. (Pl. 25, figs. 37, 38; vol. XI, pl. 25, f. 58.) In Colombia, at Carthagena and Barranquilla, a very pale form occurs, the purple on spire either faint or of typical intensity oblique streaks varying from numerous to very few, of paler tint than typical; spiral bands faint, subobsolete in the adult, subsutural and umbilical bands wanting; outer lip with an ochraceous border inside.

Lea's type specimen of *B. parvus* (see vol. XI, pl. 25, fig. 58), is a half-grown shell, dead and lusterless, with purple tip, radially striped base and with a single narrow, occasionally interrupted tawny band on the upper whorls, with some spots indicating the presence of the other band mentioned in the description; the periphery is abruptly angular; whorls $5\frac{3}{4}$; alt. 13, diam. 7 mill. It corresponds exactly with young of the form figured on pl. 25, figs 37, 38. The type of *parvus* is no. 105077 U. S. National Museum. The shell has been broken and repaired.

I have not seen specimens from Yucatan, but there is no doubt of their essential identity with *multilineatus*, as they have the same form, size and coloration, "apex violet-bluish."

## III. Species of Mexico and Central America.

Of the 50 or more species of the genus known from this area, all of which the apices have been examined show the grated sculpture typical of *Drymæus*. The species have been distributed among various subgenera by authors; thus Dr. von Martens, in his excellent account in the *Biologia Centrali Americana*, recognizes the subgenera *Drymæus*, *Mesembrinus*, *Mormus* and *Scutalus*, though he evidently lays no great stress upon them; and previous authors accept even more groups. Of these subgenera, *Scutalus* is a subordinate group of *Bulimulus*, and is here misapplied; the type of *Mormus* probably has no close genetic relation to Mexican species; and between *Drymæus* and *Mesembrinus* there is a complete chain of intermediate forms. Under these circumstances, subgeneric divisions having any

natural basis whatever, cannot be made; and while there is a great variety of forms among the several species, they must still be regarded as a nearly homogenous assemblage.

The origin of the main mass of this stock may be traced to forms emigrating from the adjacent portion of South America, at various times, probably beginning immediately after the last interruption of communication between the two oceans at the Isthmus, and continuing to the present day. A small number of forms, including probably *D. dominicus*, *totonacus*, and some of their allies, were possibly derived from the Antilles by way of Cuba and Yucatan; though the ancestors of this fauna also were ultimately from the Spanish main. That the Mexican *Drymæus* species are comparatively recent intruders from South America, is shown by their close alliance to Colombian forms, most of the "groups" into which the species fall being inseparable from those of northern South America, and by the fact that the number of these "groups" becomes much greater as we go southward, from northern Mexico to Costa Rica. Were they an old constituent of the Mexican fauna, we would expect peculiarly Mexican types, such as occur among Helices, etc.

In the following account of the species, I have quoted largely from Dr. von Martens, whose work on this genus, in the Biologia, is worthy of high praise; though the material studied has caused me to reach different results in some instances, as would be expected. With the earlier great work of Crosse & Fischer, Strebel & Pfeffer's Beiträge, and von Martens' Biologia, the Mexican Bulimulid fauna may be considered comparatively well known; though so numerous are the local races and closely allied species that much doubtless remains to be done.

*Mexican Groups of Drymæus.*

*a.* Peristome conspicuously expanded.

*b.* A broadly open rimation; no spiral striæ.

*Group of D. josephus*, p. 31.

*b'.* Perforation narrow. *Group of D. serperastrum*, p. 33.

*a'.* Peristome but slightly or not expanded.

*b.* Short-oval, no spiral striæ, peristome colored.

*Group of D. tripictus*, p.

*b'.* Elongated, moderately opaque, and usually streaked or spotted.

*c*. More or less wrinkled or plicatulate.
*Group of D. sulcosus*, p.

*c'*. Smoother. *Group of D. attenuatus*, p.

*b''*. Elongated, thin, often translucent, unicolored or with bands or rows of spots; spirally striated, nearly smooth, glossy. *Group of D. totanacus*, p.
*Group of D. sulphureus*, p.
*Group of D. alternans*, p.

*b'''*. Elongated, rather opaque, streaked or banded.
*Group of D. multilineatus*, p. 27.

### Group of D. josephus.

D. zhorquinensis (Angas). Pl. 26, figs. 14, 15.

Shell perforate and openly rimate, ovate-conic, rather solid; whitish, with oblique, spaced brown streaks, narrower than their intervals. Surface smooth, marked with slight growth lines. Spire conic, the apex rather obtuse; whorls nearly seven, convex, the first with typical *Drymæus* sculpture, the last full, very convex below, ascending toward the lip.

Aperture vertical, ovate, the *peristome very broadly expanded*, white; columellar margin broadly dilated, *channelled at its junction with the whorl;* columella with a deep spiral fold. Alt. 44, diameter 23½, length of aperture 23½ mill.

*S.-E. Costa Rica: middle Zhorquin to Cuabre*, on low hills and flat ground (Gabb).

*Bulimus zhorquinensis* Angas, P. Z. S. 1879, p. 478, pl. 40, f. 4. *Otostomus zhorquinensis* Martens, Biol. Centr. Amer., p. 202.—*Bulimulus* (*Scutalus*) *pallidior*, "specimens from Costa Rica," Dall, Proc. U. S. Nat. Mus., xvi, 1893, p. 640.

Allied to *D. josephus* only, among known Mexican shells, though as Angas remarks, the great expansion of the peristome gives it a resemblance to *D. expansus*, Pfr., which also has a widely-open rimation. Angas' figures (which are copied on my plate) do not show the broad flare of the columellar lip very well. The brown streaks are also closer than in the specimen in the Academy collection. Somewhat worn and decolored specimens collected by Senor Zeledon in Costa Rica were referred by Dall to *B. pallidior*, which they much resemble.

D. JOSEPHUS (Angas). Pl. 26, figs. 6–13.

Shell oblong-turreted, broadly rimate, thin but solid; white with thin pale buff cuticle, unicolored or with longitudinal stripes or spiral series of spots of brown. Surface glossy, smooth, the growth-lines inconspicuous, some very fine spiral lines generally to be seen on the base, under a strong lens. Spire long, conic, with convex or nearly straight lateral outlines, the apex obtuse. Whorls 7, convex, the apical with typical *Drymæus* sculpture, the last very convex and full below, slightly ascending in front.

Aperture decidedly less than half the length of shell, ovate, the peristome thin; broadly expanded, columellar margin very much dilated, impressed or channelled at the insertion above, the outer edge produced in a wide lobe; columella with a deeply entering fold.

Alt. 32, diam. 14½, length of aperture 15 mill.

Alt. 32½, diam. 15, length of aperture 13½ mill.

Alt. 30, diam. 14½, length of aperture 13 mill.

*Puerto Viejo, on the Rio Sarapiqui, in N.-E. Costa Rica* (Biolley); *San José* (Boucard) *and Talamanca* (Gabb) *in central; and on the banks of Rio Pacuare del Sur, in its middle course* at about 500 meters alt., *valley of the upper Savegal*, at 1000 meters alt., *and in the woods near Terraba; Quebrada de Tocori in the valley of the Rio Paquete, and El Pital in the valley of the Rio Naranjo, in S.-W. Costa Rica* (Pittier).

*Bulimus josephus* ANGAS, P. Z. S., 1878, p. 73, pl. 5, f. 13, 14; 1879, p. 478.—*Otostomus josephus* MART., Biol. Centr. Amer., Moll., p. 202, with var. *maculosus*, pl. 12, f. 7, and var. *concolor*, pl. 12, f. 8–10 (Aug., 1893).—*Bulimulus* (*Leptobyrsus*) *zeledoni* DALL, Proc. U. S. Nat. Mus. xvi, p. 644, pl. 71, f. 2 (Nov. 23, 1893).

Closely resembles *D. zhorquinensis* in the form of the umbilicus, peristome and columella, as well as in the color pattern; but smaller, with longer spire and less dilated last whorl.

The typical color-form (figs. 11, 12) is striped longitudinally with brown, the stripes either straight or somewhat angulated.

Color-var. *maculosus* Martens (fig. 9), has four series of square spots. It is from the banks of the Rio Pacuare del Sul, in south-western Costa Rica.

Color-var. *concolor* Mart. (figs. 6, 7, 8, 10, 13), uniform pale yellowish. Occurs in N.-E., Central and S.-W. Costa Rica. Dall's *B. zeledoni* (fig. 13) is a synonym.

GROUP OF D. SERPERASTRUM.

D. DOMBEYANUS (Férussac). Pl. 26, figs. 1, 2, 3, 4, 5.

Shell rimate-umbilicate, ovate-acuminate, white, solid, longitudinally rugose. Spire acuminate; whorls 7, flattened. Columella nearly straight, brown. Aperture oval-oblong, brown in the throat; peristome brown, very broadly expanded and reflexed; the columellar margin dilated (*Pfr.*). Alt. 62, diam. 34, length of aperture 38 mill.

*Central Mexico: On the slope of the hill Ajusco, near the city of Mexico* (*Hahn*, var.); *W. Mexico: Venta de Zopilote, State of Guerrero* (H. H. Smith).

*Helix dombeyana*, Férussac, in Mus. Paris, PFR. Symb. Hist. Helic. ii, p. 76 (1842) (without description).—*Bulimus dombeyanus*, PFR. Symb. Hist. Helic. ii, p. 114 (1842), iii, p. 83 (1846) (first description of the shell); Monogr. Helic. Vivent. ii, p. 57, vi. p. 38. —REEVE, Conch. Icon. v, *Bulimus*, pl. 30, f. 186.—*Bulimus* (*Drymæus*) *dombeyanus*, PFR. in Malak. Blätt. ii, p. 151 (1855).—*Bulimulus* (*Otostomus*) *dombeyanus*, v. MART. in Albers' Die Helic. ed. 2, p. 211; Malak. Blätt. xii, p. 23 (1865).—*Bulimulus* (*Scutalus*) *dombeyanus*, FISCH. & CROSSE, Miss. Scient. Mex., Mollusca, i, p. 515.—*Lymnæa rugosa*, VALENC., in Humboldt & Bonpland's Obs. Zool., ii, p. 250, pl. 56, fig. 5 (young) (1833).

*Bulimus alcantaræ*, BERNARDI, Journ. de Conch., iv. p. 35, pl. 3. fig. 1 (1853).—PFR., Monogr. Helic. Vivent. iv, p. 393.—*Bulimulus dombeyanus*, var. β, FISCH. & CROSSE, Miss. Scient. Mex., Mollusca, i, p. 516.—*Bulimulus dombeyanus* STREBEL, Beitr. Mex. Land und Süssw.-Conch. v, p. 74, pl. 7, fig. 3a, b.

The largest species of the genus. The variety *alcantaræ* Bernardi (pl. 26, figs. 4, 5) is distinguished by its white peristome. Von Martens writes as follows: Of three full-grown specimens before me, two exhibit the prominent edge of a former lip on the back of the last whorl, one-third or one-half of the circumference backwards from the aperture. The color of the peristome varies in these specimens from very pale brown to white, which proves that *B. alcantaræ* can scarcely be distinguished even as a variety; Strebel came to the same conclusion. The interior of the aperture is also, in the variety, brownish. The young specimen from Venta de Zopilote (pl. 26, figs. 2, 3), has a pale-brown band immediately below the angular periphery, as in the figure given by Valenciennes.

It is a curious fact that previous to the year 1882 no exact locality was known for this very remarkable shell, the largest of the Mexican species of this genus. It seems that in the Paris Museum it has been mixed with shells collected by Mr. Dombey in Peru, or rather Chili: see Lamarck, Hist. Nat. des Anim. sans Vert. ed. I, vi, p. 141, *Auricula* (*Chilina*) *dombeyana*, and ibid. p. 76, *Helix peruviana*, identical with *laxata*, Fér., which both inhabit Chili and not Peru; hence the name "*dombeyanus*," and the erroneous indication of Peru as habitat. Bernardi's assertion that his specimen came from the Solomon Islands is still less trustworthy.

The name *alcantaræ* was given in honor of the then Prince-Royal of Portugal, Dom Pedro de Alcantara, afterwards king (1861).

D. FENESTRATUS (Pfeiffer). Pl. 7, figs. 11, 12, 13, 14.

Shell rimate-umbilicate, conic-ovate, rather solid, sculptured with oblique *minutely undulating*, *close* striæ and some spiral impressed lines; brown-whitish, painted with five interrupted blackish bands; spire conic, rather acute, pale flesh colored above. Whorls 7, a little convex, the last very shortly ascending in front, narrowed and rounded at base.

Aperture oval-oblong, little oblique, a little exceeding half the shell's length; columella pliciform, receding, *intense violaceous;* throat violaceous-brown; peristome rather widely reflexed, *white;* columellar margin somewhat dilated, white; parietal callus distinct, violaceous (*Mart.*).

Alt. 51, diam. 26, length of aperture 28 mill.

*Manzanillo near Colima, western Mexico* (Pieschel).

*Bulimus fenestratus* PFR., P. Z. S., 1846, p. 29; Monogr. Helic. Vivent., ii, p. 101.—REEVE, Conch. Icon. v., *Bulimus*, pl. 36, fig. 214. *Orthalicus* (*Mesembrinus*) *fenestratus* H. & A. ADAMS, Gen. Moll. ii. p. 157.—*Bulimulus* (*Scutalus*) *fenestratus* FISCH. and CROSSE, Miss. Scient. Mex. Mollusca, i, p. 528.—*Bulimulus* (*Otostomus*) *piescheli* v. MART. in Monatsb. Akad. Wiss. Berl. 1863, p. 541; Malak. Blatt. xii, p. 22, pl. 1, fig. 10 (1865).—*Bulimus piescheli* PFR., Monogr. Helic. Vivent, vi. p. 38.—*Bulimulus* (*Scutalus*) *piescheli* FISCH. and CROSSE, Miss. Scient. Mex., Mollusca, i, p. 509.—*Bulimulus piescheli* STREBEL, Beitr. Mex. Land- und Süssw.-Conch. v, p. 77. *Otostomus fenestratus* v. MART., Biol. Centr. Amer., Moll., p. 200, pl. 12, f. 1, 1 a, b.

Fig. 11 is Pfeiffer's original *fenestratus;* figs. 12–14 represent the unique type of *piescheli* Mart.

This species, writes von Martens, is somewhat intermediate between *O. dombeyanus* and *O. lilacinus*, but is nearer to the latter, from which it differs chiefly in the much rougher, wrinkled and malleated sculpture. The apex is unicolorous white with a reddish hue, and smooth; the band commences on the third whorl, and only three are visible on all whorls except the last, the two others being concealed by the following whorl. The sculpture consists of broad raised wrinkles, most of which are covered by much finer undulated lines.

I have seen only one specimen (pl. 7, figs. 12–14), collected at the above-mentioned locality and given to the Berlin Museum by Herr Pieschel, once Secretary of the Prussian Embassy to Mexico. From Reeve's figure it is evident that the original specimen of Pfeiffer's *Bulimus fenestratus* in Cuming's collection belongs to the same species; but in the German collections this name has been applied by Philippi to another species, in which the light intervals between the dark bands and streaks have not the appearance of bow- or bay-windows, but the interrupted brown bands themselves represent square windows.

Pfeiffer himself seems to have confounded afterwards his own species with another, figured by Philippi as "*B. fenestratus*" (see *O. dunkeri*, Pfr.), as the specimen from Pfeiffer's collection described and figured by Strebel, Beitr. Mex. Land und Süssw.-Conch. v, p. 75, t. 6, fig. 19, evidently belongs to the latter; therefore neither the name of Liebmann as collector,) which is not mentioned by Pfeiffer in the first description,) nor its position in the subgenus *Drymæus*, close to *B. dunkeri* (Pfeiffer, Malak. Blätt. 1855, p. 151), can be safely quoted for this species.

D. LILACINUS (Reeve). Pl. 7, figs. 1–10.

Shell umbilicate, oblong-pyramidal, rather solid, somewhat roughly striate; white, ornamented with purple-brown bands which are here and there interrupted. Spire long conic, rather acute; whorls $7\frac{1}{2}$ to 8, a little convex, the last about two-sevenths the entire length, base somewhat compressed around the rather wide, compressed, violaceous umbilicus. Columella inflated, somewhat twisted, lilac colored. Aperture little oblique, semioval-auriform, lilac within, banded;

peristome broadly expanded, white, the columellar margin much dilated, vaulted. Alt. 47, diam. 18, length of aperture inside, 18 mill. (*Pfr.*)

*Western and southwestern Guatemala; Nicaragua.*

*Bulimus lilacinus* Reeve, Conch. Icon. v, *Bulimus*, pl. 74, fig. 532 (1849) (young specimen).—Pfr., Monogr. Helic. Vivent. iii, p. 326.—*Bulimus* (*Drymæus*) *lilacinus* Pfr. in Malak. Blätt. ii, p. 151 (1855).—*Otostomus* (*Hamadryas*) *lilacinus* H. & A. Adams, Gen. Moll. ii, p. 150.—*Bulimulus* (*Drymæus*) *lilacinus* Albers, Die Helic. ed. 2, p. 211.—Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 479, pl. 20, figs. 1, 2; pl. 24, figs. 5, 5a.—*Otostomus* (*Drymæus*) *lilacinus* v. Mart., Conch. Mittheil. ii, p, 191; Biol. Centr. Amer., Moll, p. 201, pl. 12, f. 3–6. — *Bulimus patricius* Reeve, Conch. Icon. v, *Bulimus*, pl. 81, fig. 600 (Dec. 1849).

"According to the MS. notes of Dr. O. Stoll, this species, and especially the var. *unicolor*, is characteristic of the forests of the western or Pacific slope of the Guatemalan Cordillera, at an elevation of between 3000 and 4000 feet above the sea, descending in some localities nearly to 2000 feet. The specimen collected by Mr. Champion at El Reposo in the lowlands between Retalhuleu and the Pacific coast is remarkably small, attaining only 36½ millim. in length; it exhibits, nevertheless, the remains of an older expanded aperture (such as is often to be seen in *O. dombeyanus*) at the back of the last whorl, which corresponds to a length of 30 millim. This early building of an aperture, as if it were adult, seems to indicate a longer interruption or slowness of growth, caused by unfavorable conditions of the locality. The var. *d*, which I know only from the description and figure of Fischer and Crosse, closely resembles, at first sight, *O. chiapensis*." (*Martens.*)

Von Martens gives the following varieties:

*a. Typical* (figs. 1, 2, 3). 4–5 purple brown bands, striolate, frequently interrupted; throat violaceous; peristome yellow-bordered outside. (Reeve, fig. 600; Fisch. & Crosse, pl. 20, fig. 1, 2.)

*S. W. Guatemala: San Augustin, department of Solola* (Bocourt); same locality, at an elevation of 3000 feet above the sea (Stoll).

*b. Undulosus* (fig. 4). Pale violaceous, with undulating violaceous streaks; throat violaceous, peristome yellow outside.

*W. Guatemala: Hacienda de las Nubes, Cerro Zunil, Pacific slope*, 4000 feet alt. (Champion).

*c. Unicolor :* white, the columella only violaceous, peristome yellow outside.

*Bulimulus* (*Drymæus*) *lilacinus* var. β, Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 479.—*Bulimulus delattrei*, schlanke Lokalform, Stoll, Guatem. Reisen, p. 198 (1886).

*W. Guatemala: Cholhuitz* (Stoll); *Cerro Zunil* 4000 feet; *El Reposo* 1000 feet (Champion); *Hacienda Buenavista and Hacienda Helvetia*, in virgin forest, at an elevation of from 3000 to 4000 feet, descending in some localities to about 2000 feet (Stoll); *Cuesta between Antigua and Escuintla* (Stoll).

*d. Crossei* (figs. 5, 6). White, with three narrow brown continuous bands, the peristome whitish outside.

*Bulimulus* (*Drymæus*) *lilacinus* var. γ, Fisch. & Crosse, loc. cit. p. 479, pl. 24, fig. 5, 5a.

*N. Guatemala: Alta Vera Paz* (Sarg).

*e. Jansoni* (figs. 7, 8, 9). Fleshy, whitish, with 4 purple-brown interrupted bands, and some narrow streaks; peristome whitish outside, the throat roseate. Alt. 46, diam. 22, apert. 24 mill.

*Nicaragua* (Janson).

*f. Ictericus* (fig. 10). More slender, unicolored, yellow, the columella only violaceous.

*W. Guatemala, Cerro Zunil* (Champion).

D. serperastrum (Say). Pl. 9, figs. 34–41.

Shell umbilicate, oblong-ovate, thin but moderately strong; white or ochre tinted, with *six blackish bands, the upper four or all of them irregularly interrupted into oblong spots*, bands iii and iv frequently having the spots coalescent; in some specimens all markings absent. Surface shining, somewhat wrinkled and finely malleated, the degree of rugosity very variable; some fine interrupted spiral lines generally visible under the lens. Spire long, conic, the apex rather obtuse, with typical *Drymæus* sculpture. Whorls 6 to $6\frac{2}{3}$, moderately convex.

Aperture ovate, banded within; peristome expanded, white, thin, the columellar margin reflexed above.

Alt. 38, diam. 18, length of aperture 18 mill. (Say's type.)

Alt. 35, diam. 16, length of aperture 16 mill. (Ticul.)

Alt. 33, diam. $16\frac{1}{2}$, length of aperture, 17 mill. (Ticul.)

Alt. 30, diam. 14, length of aperture, 15 mill. (Sitilpech.)

Alt. $33\frac{1}{2}$, diam. $13\frac{1}{2}$, length of aperture, 15 mill. (Tekanto.)

*Bulimus serperastrus* Say, New Harmony Disseminator, Jan. 1, 1829, p. 25 (ed. Binney, p. 30).—Pfr., Monogr. Helic. Vivent. ii, p. 102; iii, p. 341; and in Martini & Chemnitz, Syst. Conch. Cab. ed. 2, *Bulimus*, p. 82, pl. 32, fig. 1, 2, pl. 39, fig. 5.—Reeve, Conch. Icon. v, *Bulimus*, pl. 40. fig. 252.—Philippi, Abbild. neuer Conch. iii, p. 97, *Bulimus*, pl. 9, fig. 6.—Binney, Terr. Air-breath. Moll. N. Am., ii, p. 274, pl. 50, fig. 2, and iv, p. 126.—*Bulimus* (*Drymæus*) *serperastrus* Pfr. in Malak. Blätt. ii, p. 152 (1855).—*Bulimulus* (*Drymæus*) *serperastrus* v. Mart., in Albers' Die Helic., ed. 2, p. 212.—Binney & Bland Land and Fresh-water Shells of N. Am., i, p. 192, fig. 334, 335 (the latter copied from a drawing by Mrs. Say)—Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 488, pl. 24. fig. 4 (copied from Mrs. Say's drawing).—*Drymæus serperastrus* Tryon, in Am. Journ. Conch. iii, p. 167, pl. 9 (13), fig. 4.—*Bulimulus serperastrus* Strebel, Beitr. Mex. Land und Süssw.-Conch. v, p. 83, pl. 6, fig. 12.—Stearns, North Amer. Fauna no. 7, p. 274.—*Bulimus liebmanni* Pfr., in Zeitschr. für Malak. 1846, p. 158; Monogr. Helic. Vivent. ii, p. 106.—*Bulimus ziebmanni* (error for *liebmanni*) Reeve, Conch. Icon. v, *Bulimus*, pl. 70, fig. 506.—*Bulimus* (*Mesembrinus*) *liebmanni* Albers, Die Helic. ed. i, p. 157.—*Orthalicus* (*Mesembrinus*) *liebmanni* H. & A. Adams, Gen. Rec. Moll., ii, p. 157.—*Bulimus nitelinus* Reeve, Conch. Icon. v, *Bulimus*, pl. 59, fig. 398 (young specimen).—*Bulimus paivanus* Pfr., in Malak. Blätt. xiii, p. 81 (1866); Novit. Conch. iii, p. 309, pl. 75, fig. 4, 5; Monogr. Helic. Vivent. vi, p. 35.—*Bulimulus* (*Drymæus*) *paivanus* Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 490, pl. 21, fig. 1, 1a.—*Bulimulus paivanus* Strebel, Beitr. Mex. Land und Süssw.-Conch. v, p. 82, pl. 6, fig. 11; pl. 12, fig. 18; pl. 13, fig. 12 (radula), pl. 14, fig. 9 G. (genitalia), 10 A, B, D, 11; pl. 16, fig. 3 (jaw)—*Otostomus paivanus* v. Mart., Conch. Mittheil. ii, p. 192.—*Otostomus serperastrum* v. Mart., Biol. Centr. Amer., Moll., p. 203.

*E. Mexico: on the road between Vera Cruz and Mexico* (Say); *Jalapa* (Höge); *Tierra Colorada, between Jalapa and Vera Cruz* (Doña Estefania); *Paso de San Juan and Loma de Piedra on the Rio Jamapa, near Vera Cruz;* and *between Paso de Ovejas and the plantation of Mirador* (Strebel); *Bobo, near the Port of Vera Cruz* (Höge); *Vera Cruz, in the littoral region* (Berendt). *N.-E. Mexico: Hidalgo, Tamaulipas* (Wm. Lloyd). *Yucatan: Sisal* (Morelet); *Port of*

*Silam*, *Ticul*, *Tekanto*, *Sitilpech and Uxmal* (Heilprin, Baker et al.).

Seems to range from the State of Tamaulipas to Yucatan, where, in the northern part of the peninsula at least, it is a common species. Although extremely variable in coloration, form and size, it is readily recognized, and not closely allied to any species but the following.

Fig. 35 is copied from a drawing by Mrs. Say of the type specimen, which is still extant in the collection of the Academy. It is the largest shell of a considerable series before me.

Binney records *serperastrum* from Texas, but without giving any definite locality. Its occurence north of the Rio Grande requires confirmation, as it has not been found in Texas during the last forty years or more.

D. ZIEGLERI (Pfeiffer). Pl. 40, figs. 4, 5, 6.

Shell oblong-conic, rather slender, perforate; opaque white, unicolored or with a few oblong spots arranged in vertical rows, or interrupted bands (six in number when most developed) of dark brown: surface lightly striatulate and showing fine faint spiral lines under the lens. Spire long, apex obtuse, yellowish-corneous, with typical *Drymæus* sculpture. Whorls 6, slightly convex, the last somewhat tapering below.

Aperture less than half the shell's length, oblong, the lip slightly expanded below, columellar lip reflexed; columella nearly straight.

Alt. 29, diam. 12½, length of aperture 13½ mill.

*Mazatlan, N.-W. Mexico, also Altata* (Stearns).

*Bulimulus ziegleri* PFR., P. Z. S., 1846, p. 113, exclusive of var. β. *Orthalicus ziegleri* CPR., Maz. Catal., p. 177. *Bulimulus ziegleri* BINNEY, L. and F.-W. Sh., N. A., i, p. 193, f. 336.—STEARNS, Proc. U. S. Nat. Mus. xvii, p. 165.—*Bulimus californicus* Reeve.

The description and figures 4, 5, are from Mazatlan specimens in the collection of the Academy. These vary from whitish without markings to sparsely spotted, and finally to as fully developed a pattern as *D. serperastrum*. Perhaps Carpenter's *Orthalicus ? mexicanus* (Maz. Cat. p. 177) was a banded specimen; it was a solitary shell. Fig. 6 is copied from Binney's figure of a specimen received from Pfeiffer.

Closely allied to *D. serperastrum*, but more slender, smoother, more polished than most specimens of that species, and showing

microscopic, close spiral striæ more clearly on the base. The main distinction, however, is geographic, *serperastrum* being an eastern, *ziegleri* a western form. So far as present information goes, its range is separated from that of *serperastrum* by the table-land of Mexico.

The original description of *B. ziegleri* Pfr., which was drawn from a small or immature specimen, is as follows: Shell subperforate, ovate-conic, thin, closely striatulate, obsoletely decussated with spiral lines, under the lens; whitish; spire conic, rather acute. Whorls 6, a trifle convex, the last subangulate in the middle, a little shorter than the spire; columella a little receding; aperture oval; peristome simple, the columellar margin narrowly reflexed, subappressed. Long. 21, diam. 10 mill. Aperture 10 mill. long., 6 wide (*Pfr.*, Proc. Zool. Soc. 1846, p. 113). Locality unknown.

A var. $\beta$, with the shell pellucid, buff, encircled by chestnut bands, on the upper whorls interrupted into spots, is also described. This variety is figured by Reeve, Conch. Icon. pl. 58, f. 389. Von Martens refers it to *B. emeus* Say. Probably it has nothing to do with the typical *ziegleri*.

In the Monographia, Pfeiffer gives the localities Central America (Largilliert) and Mexico? (Liebmann). Pfeiffer furnished to Binney the shell figured as *ziegleri* in L. and F.-W. Sh. N. A., p. 193, f. 336. Carpenter records it from Mazatlan, as *Orthalicus ziegleri* (Maz. Catal. p. 177).

From the series before me, I am disposed to consider the Mazatlan *ziegleri* as identical with *californicus* specifically; the description of the latter here follows:

*B. californicus* Reeve (pl. 49, fig. 34). "Shell somewhat acuminately ovate, rather thin, scarcely umbilicated; whorls 6 in number, smooth; columella reflected; lip simple. Cream color, encircled with interrupted transverse blue-black zones."

*Gulf coast of Lower California* (Stearns), or perhaps mainland coast of the Gulf; *California* (Hartweg, according to Reeve).

*Bulimus californicus* Reeve, Conch. Icon. pl. 56, f. 378 (Dec., 1848).—Pfr., Monogr. iii, p. 122.—Binney, Land and F.-W. Sh. N. A., i, p. 199, f. 345.—*Bulimulus* (*Drymæus*) *californicus* Dall, Proc. U. S. Nat. Mus. xvi, 1893, p. 641.—Stearns, ibid. xvii, 1894, p. 165.

As stated above, this is apparently the much variegated extreme

of the typically spotless *ziegleri*. It is of course not found in California in the present limits of that State, and probably not on the peninsula.

D. LATTREI (Pfeiffer). Pl. 8, figs. 15–26, 28.

Shell perforate, ovate-conic, thin but rather solid; white or whitish, either unicolored, or 4 or 5 banded, or longitudinally streaked with brown or purple-brown. Surface shining, irregularly striated, finely malleated, and usually showing fine spiral lines in places. Spire conic, the apex obtuse. Whorls $5\frac{2}{3}$–$6\frac{1}{3}$, but slightly convex, the last large, oval.

Aperture large, but slightly oblique, colored within like the outside; outer lip reflexed, white; columellar lip reflexed and appressed; columella and part of the parietal wall purple.

Alt. 40, diam. 19, length of aperture 22 mill.

Alt. 45, diam. 19, length of aperture 25 mill.

Alt. 43, diam. 23, length of aperture 27 mill.

*Northern and Central Guatemala.*

*Bulimus lattrei* PFR. in Philippi's Abbild neuer Conch. ii, p. 112, pl. 4, fig. 11 (1846); Monogr. Helic. Viv. ii, p. 56—DESHAYES, in Férussac's Hist. Nat. Moll. Terr. ii, 2, p. 48, pl. 111, figs. 12, 13, pl. 149, figs. 12, 13.—*Bulimus* (*Gonyostomus*) *lattrei* ALBERS, Die Helic. ed. 1, p. 150.—*Bulimus* (*Eurytus*) *lattrei*, v. MART. in Albers' Die Helic. ed. 2, p. 195.—*Bulimus* (*Drymæus*) *lattrei* PFR. in Malak. Blätt. ii, p. 151 (1855).—*Otostomus* (*Goniostomus*) *lattrei*, H. & H. ADAMS, Gen. Rec. Moll. ii, p. 151.—*Bulimulus* (*Drymæus*) *delattrei* FISCH. & CROSSE, Miss. Scient. Mex. Mollusca, i, p. 481, pl. 20, fig. 3 (living anim.), 4; pl. 22, fig. 1–14 (jaw, radula, anatomy.—*Otostomus* (*Drymæus*) *delattrei*, v. MART. Conch. Mitth. ii, p. 191; Biol. Centr. Amer., Moll., p. 204, pl. 12, f. 11–14. *Bulimus focillatus* REEVE, Conch. Icon. v, *Bulimus*, pl. 36, fig. 211 (1848).—*Bulimus pazianus*, TRISTR., P. Z. S., 1861, p. 230 (not Pfr. nor Orbigny).

A large species, varying much in contour, comparative size of aperture and coloration. In some obscurely streaked examples, such as that shown in fig. 25, the interior of the aperture is purple; and this color almost always tints the columella. Very commonly two or more of the color-varieties defined by von Martens occur together.

Von Martens recognizes the following forms:

Normal form. Sculpture strong; aperture about $\frac{4}{7}$ the length of the shell; large (length about 40 mill.).

*a.* (Fig. 20.) Pale lilac, with a few narrow brownish streaks. (Pfr., Monogr. ii, p. 56, form *a;* Reeve, loc. cit. fig. 211 *c;* Deshayes, loc. cit. p. 48, troisième variété.)

*N. Guatemala: Vera Paz.* (by error "Vera Cruz" in Monographia); *Coban* (Salvin, Bocourt). *Central Guatemala: Department of Salama* (Morelet); *San Gerónimo near Salama* (Champion).

*b.* (Figs. 21–24). Pale lilac, with interrupted bluish bands (Pfr. Monogr. Helic. Vivent. ii. p. 56, form $\beta$, and in Philippi, loc. cit. middle fig.; Reeve, loc. cit. fig. 211 b; Deshayes, loc. cit. pl. 111. fig. 12, 13; Fisch. & Crosse, loc. cit. p. 481; Martens, fig. 11).

*North Guatemala: Vera Paz* (Delattre). *Central Guatemala: San Gerónimo* (Champion).

*c.* (Figs. 15, 16). Uniform straw colored or whitish, the columella violaceous. (Pfr. Monogr. Helic. Vivent. ii, p. 56, form $\gamma$, and in Philippi, loc. cit. right fig.; Reeve, loc. cit. fig. 211*a;* Deshayes, loc. cit. pl. 149, figs. 12, 13; Martens, fig. 12).

*North Guatemala: Vera Paz* (Delattre); *Coban* (Salvin, Bocourt, Conradt). *Nicaragua* (Janson).

Var. *hiabundus* Martens. Smoother, aperture about $\frac{3}{5}$ the length of shell; small (length about 30 mill.).

*d.* White, with 3–5 wide purple-brown bands (fig. 17–19).

*e.* uniform white (fig. 28).

*W. Guatemala: Cerro Zunil* (Champion).

D. CHIAPASENSIS (Pfeiffer). Pl. 8, figs. 27, 29–33.

Shell narrowly perforate, ovate-conic, rather solid, striate and decussated by very fine spiral striæ; dull whitish, the spire conic with slightly convex outlines, apex rather acute, suture lightly impressed, very finely serrate. Whorls $5\frac{1}{2}$, a little convex, the last longer than the spire, ascending slightly in front, subcompressed at base. Columella thread-like, slightly arcuate. Aperture oblique, oval; shining white inside; peristome simple, the outer margin strongly dilated below, expanded; columellar margin dilated above. Alt. 35, diam. 14, length of aperture 21 mill. (*Pfr.*)

*States of Chiapas and Vera Cruz, Mexico.*

*Bulimus chiapasensis* Pfr. in Malak. Blätt. xiii, p. 81 (1866);

Monogr. Helic. Vivent. vi, p. 42; Novit. Conch. iii, p. 417, pl. 95, figs. 3–6.—*Bulimulus* (*Drymæus*) *chiapasensis* Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 483.—*Bulimulus chiapasensis* Strebel, Beitr. Mex. Land- und Süssw.-Conch., v, pp. 70–73, pl. 5, fig. 14 *a*, *b*, *c*; pl. 6, fig. 13, 15, 16; pl. 12, fig. 19 *a*, *b*, *c*.—*Bulimulus* (*Drymæus*) *delattrei*, var. δ, ε, Fisch. & Crosse, loc. cit. pl. 20, fig. 5, 6.—*Otostomus chiapensis* v. Martens, Biol. Centr. Amer., Moll., p. 205, pl. 12, f. 15.

Dr. von Martens arranges the color-varieties thus:

*a. typicus:* Uniform white (figs. 27, 30, 31). (Pfr. Novit. Conch., fig. 5, 6; Fisch. & Crosse, loc. cit. fig. 6; Strebel, loc. cit. pl. 6, fig. 13; pl. 12, fig. 19 *b*.)

*E. Mexico: Cordova* (Sallé); *Cerro de Palmas near Cordova* (Höge); *Orizaba* (Berendt, Botteri); *Coatepec* (Quiroz). *Central Mexico: Cuautitlan* (Strebel). *S. Mexico: Cumbre de Manzanilla, in the State of Chiapas* (Ghiesbreght).

*b. quadrifasciatus.* Whitish with four continuous brown bands. (Fig. 32.) (*Bulimulus chiapasensis*, var. γ, Fisch. & Crosse, loc. cit. fig. 6; *B. chiapasensis-delattrei*, Strebel, loc. cit. fig. 19 *a*, *c*.)

*E. Mexico: Matlaquihahuitl, in the State of Vera Cruz* (Sallé); *Cerro de Plumas near Cordova* (Höge).

*c. nebulosus:* clouded, the suture white, throat brown (fig. 33). (*Bulimulus chiapasensis*, form D (part), Strebel, loc. cit. p. 72, pl. 6, fig. 15, 16.)

*E. Mexico: Coatepec* (Quiroz); *Quimistlan, between Coatepec and the borders of the State of Puebla* (Dona Estefania). *Central Mexico; Cuautitlan* (Strebel).

D. castus (Pfeiffer). Pl. 9, figs. 42–53.

Shell perforate or nearly closed, ovate-fusiform, rather thin, white or whitish, often becoming pink or brown on the spire, and either without markings or with three spiral bands, or spaced longitudinal streaks of purplish-brown. Surface glossy, *densely and regularly spirally striate* under a lens. Spire long, the apex rather obtuse, with typical *Drymæus* sculpture, last whorl lengthened and graceful.

Aperture large, white or marked inside; *peristome very broadly expanded, flaring*, white or pinkish; columellar margin narrowly reflexed, and with the parietal wall, pink in color.

Alt. 34, diam. 15, length of aperture 18 mill.

Alt. 27, diam. 12, length of aperture 14½ mill.

*Northern Guatemala.*

*Bulimus castus* Pfr., P. Z. S. 1846, p. 112; Monogr. Helic. Vivent. ii, p. 47.—Reeve, Conch. Icon. v, *Bulimus*, pl. 45, fig. 282. —Tate, Am. Journ. Conch. v, pp. 152, 156 (1870).—*Bulimus* (*Leiostracus*) *castus* Pfr. in Malak. Blatt. ii, p. 153 (1855).—*Otostomus* (*Leiostracus*) *castus*, H. & A. Adams, Gen. Rec. Moll. ii, p. 151.—*Bulimulus castus* v. Mart., in P. Z. S. 1875, p. 648.—*Bulimulus* (*Drymæus*) *castus*, Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 485, pl. 24, figs. 11, 11 *a-d*.—*Otostomus castus* v. Martens, Biol. Centr. Amer., p. 206, pl. 12, f. 16–21.

Peculiarly graceful in contour, and while allied to the two species preceding, yet easily distinguished by its slender form, smooth, not malleated surface, fine spiral striation, and purity of coloring.

Pfeiffer's types were whitish, with a blush toward the base and aperture, the peristome roseate. Dr. von Martens offers the following arrangement of varieties and variations.

A. *typicus;* Small, length 19–23, diam. 11, aperture 10–12½ mill.

*a:* unicolored, white, peristome, more or less roseate.

*b:* irregularly streaked with brown (Fig. 42).

*c:* Three blackish-brown bands, either interrupted (Reeve, loc. cit. fig. 282) or continous (fig. 43, 44).

*Central America: probably Vera Paz* (*Delattre* var. *a*). *N. Guatemala: Coban* (Morelet, Salvin: varr. a, b, c); *Tamahu* (Sarg).

B. *xantholeucus:* large, a little more inflated, length 25, diam. 14, apert. 15 mill.); white, apex and peristome yellowish (Fig. 52, 53).

*N. Guatemala: Sabo*, in a tributary valley of the River Polochic, at an elevation of 3800 feet above the sea (Champion).

C. *porrectus:* Elongated, more slender, length 30–35, diam. 14–15, apert. 18–19 mill.)

*a.* Uniform white, the columella only pink (Figs. 47, 49), (*Bulimulus castus* var. B, Fisch. & Crosse, loc. cit. fig. 11 b.)

*b.* Two or three purple-brown bands, the aperture roseate (figs. 45, 46). (*Bulimulus castus* var. γ, Fisch. & Crosse, loc. cit. fig. 11 *c, d*).

*c.* Streaked, columella only roseate (Fig. 48.)

*N. Guatemala: Coban or Tamahu* (Morelet or Sarg.: varr. *a, b*); *Vera Paz* (Stoll: varr. *b, c*).

"The three varieties, A, B, C, appear to be distinct at first sight,

but there are transitions between them in size, form, and color. For example, one of Dr. Stoll's specimens from Vera Paz (fig. 48) is only 27 millim. long, but it exhibits the slender figure and more solid shell of Var. C. Fischer and Crosse do not give separately the localities for the different varieties which they have described and figured. Tate doubtfully records the occurrence of the species in Nicaragua—'in the mountain-forests of Javali and Peña Blanca, at an elevation of about 2500 feet above the sea,' and at 'Chontales;' he does not mention either the size or the coloration of his specimens, so that we cannot refer them even by conjecture to any of the three forms which are indicated above." (*Martens.*)

D. DUNKERI (Pfeiffer). Pl. 10, figs. 54, 55; pl. 15, fig. 31.

Shell perforate, ovate-conic, rather thin, longitudinally roughly striate and obsoletely reticulated by impressed spiral lines; whitish-buff, streaked and maculated with reddish-brown, and with smaller scattered white spots. Whorls 6, rather flat, the last as long as the spire. Columella vertical, inflated; aperture oblong-oval; peristome simple, the margins distant, outer lip somewhat expanded, columellar lip broadly reflexed; Alt. 37, diam. 16, length of aperture 19 mill. (*Pfr.*)

*Central Mexico: State of Michoacan* (Hegewisch, Uhde); *Lake Patzcuaro*, in the same state (Baker, Heilprin). *W. Mexico: Tepic* (Richardson); *inland from Guaymas* (Gabb, pl. 15, fig. 31).

*Bulimus dunkeri* PFR. in Philippi's Abbild. neuer Conch. ii, p. 112, pl. 4. fig. 10 (1846); Monogr. Helic. Vivent. ii, p. 101—REEVE, Conch. Icon. v, *Bulimus*, pl. 74, fig. 533.—*Bulimus* (*Mesembrinus*) *dunkeri* ALBERS, Die. Helic, ed. i, p. 157.—*Bulimus* (*Drymæus*) *dunkeri* PFR. in Malak. Blätt., ii, p. 151 (1855).—*Orthalicus* (*Mesembrinus*) *dunkeri*, H. & A. ADAMS, Gen. Rec. Moll. ii, p. 157. —*Bulimus* (*Scutalus*) *dunkeri* v. MART. in Malak. Blätt., xii, p. 36 (1865).—FISCH. & CROSSE, Miss. Scient. Mex., Mollusca, i, p. 511. —*Bulimulus dunkeri* STREBEL, Beitr. Mex. Land- und Süssw.-Conch. v, p. 76.—*Otostomus dunkeri* v. MART., Biol. Centr. Amer., Moll., p. 207, pl. 13, f. 1.

The typical form (pl. 10, figs. 54, 55; pl. 15, fig. 31, specimen from inland from Guaymas) is easily recognizable by the pale round spots on a brownish ground. In the variety the brown color is limited to more or less numerous patches, which are either somewhat

square and arranged in spiral rows (*Philippi*, and specimens from Chihuahua), or more irregular and combined, sometimes at acute angles (specimen from Ventanas). In a specimen from Chihuahua the pale spots of the type are seen within some of the larger brown patches. The sculpture of this species is somewhat coarsely rugoso-striate, but it cannot be termed undulated, as in *O. fenestratus* Pfr. Most of the specimens I have seen show remarkable irregularities and scars, some even at the apex, caused by previous fractures during life. Probably they live on conspicuous objects during the wet season, and often fall to the ground. (*Martens.*)

Var. *forreri* (Mousson). Pl. 10, figs. 56, 57, 58.

Shell oblong-ovate, rimate-perforate, rather thin, irregularly subplicose-striate; dull whitish, painted with grayish spots in series or obscure zigzag streaks and clouds. Spire conic, the outlines a trifle convex, apex white, polished; suture a little impressed, rather irregular. Whorls 6, a little convex, regular, the last not descending, ovate, subvertical, longer than the spire. Aperture broadly oval, whitish inside, weakly showing the markings through; peristome well expanded, acute, the margins converging, joined by a very thin lamina; columellar margin broadly reflexed. Alt. 37, diam. 21 mill. (*Mouss.*)

*N. Mexico: Chihuahua* (Höge) *N. W. Mexico: Ventanas, State of Durango* (Forrer), *and near Mazatlan* (Gabb).

*Bulimus fenestratus* (Pfr.), Phillipi, Abbild. neuer Conch. iii, p. 96, pl. 9, fig. 1, 5.—*Bulimulus fenestratus* Strebel, Beitr. Mex. Land- und Süssw.-Conch., v. p. 75, pl. 6, fig. 19.—*Bulimus* (*Mesembrinus*) *fenestralis* Albers, Die Helic. ed. 1, p. 157 (misprint).—*Bulimulus forreri*, Mousson, Journ. de Conch., xxi, p. 217, pl. 9, 2 (1883).—*Otostomus dunkeri* var. *forreri* Martens, Biol. Centr. Amer., Moll., p. 207, pl. 13, f. 2, 2 *a*.

D. chaperi (Crosse & Fischer). Pl. 15, figs. 29, 30.

Shell nearly covered perforate, long-ovate; dull whitish, with rather widely-spaced pale-brown streaks and longitudinal, close, somewhat oblique impressed wrinkles. Spire rather long, the apex rounded, suture simple. Whorls $6\frac{1}{2}$, a little convex, the first two smooth, the following strongly wrinkle-striate, last longer than the spire, ventricose, inflated, tapering at base.

Aperture oblong-ovate, whitish inside; peristome simple, whitish,

the margins distant, columellar margin expanded, nearly closing the perforation, basal and outer margins thin, subexpanded, a little reflexed.

Alt. 43, diam. 25, length of aperture 26 mill. (*C. & F.*)

*Island of Mescala, in lake Chapala, State of Jalisco, Mexico.* (Chaper).

*Bulimulus chaperi* C. & F., Jour. de Conch., 1892, p. 296 (1893); 1893, p. 31, pl. 1, f. 1, 2.—Fischer, *t. c.*, p. 32, pl. 1, f. 2 (animal living).

This species, of which I have not seen specimens, should probably stand as a race or variety of *D. dunkeri*. It is near var. *forreri* Mousson.

D. colimensis (Rolle).

Shell conic-elliptical, perforate, rugose-striate, whitish, ornamented with three series of violaceous-brown spots on the whorls of the spire, five on the last whorl. Whorls 6½, rather flattened, separated by a slightly impressed suture, the upper 3 whorls unicolored, apex rather obtuse, last whorl more convex, perceptibly tapering at base, brown tinted in the umbilical region.

Aperture elliptical, very slightly oblique; peristome narrowly expanded, thin, white, the basal margin narrowly rounded, columellar margin rather widely reflexed, triangularly dilated above, violaceous tinted in well-preserved specimens; parietal callus thin but distinct.

Alt. 31, diam. 15, length of aperture 15 mill. (*Rolle*).

*Colima, Mexico.*

*Otostomus colimensis* Rolle, Nachrichtsbl. d. d. Malak. Ges., xxvii, p. 130 (August, 1895).

According to Rolle this is nearest to *D. fenestrellus* and *D. dunkeri* var. *forreri*, distinguished from the former by the reflexed peristome, from the latter by the more lengthened contour and less obese whorls.

## Group of D. sulcosus.

D. botterii (Crosse and Fischer). Pl. 15, figs. 34, 35.

Shell perforate, oblong-conic, rather thin, but somewhat solid, a little shining, impressed with rather strong, somewhat distant *longitudinal wrinkle-striæ, decussated by numerous very delicate transverse liræ*, visible only under a lens; pale fleshy reddish, transversely

banded obscurely with brown. Spire conic, the apex a little obtuse, suture irregularly impressed. Whorls $5\frac{1}{2}$, a little convex, the embryonal $1\frac{1}{2}$ smoothish, pale fleshy-brown, the last whorl a little longer than the spire, obscurely three-banded with brown.

Aperture subovate, shining and fleshy-white within, vividly showing the external bands; peristome a little expanded, milk white, the margins separated; columella somewhat twisted inside, reflexed, dilated, partly closing the perforation; basal and outer margins a little reflexed, the outer narrowing toward its insertion.

Alt. 32, diam. 15; length of aperture scarcely 17 mill. (*C. & F.*)

*Near the city of Orizaba* (Botteri.).

*Bulimulus* (*Drymæus*) *botterii*, Crosse & Fisch. in Journ. de Conch. xxiii, p. 52 (1875); Miss. Scient. Mex., Mollusca, i, p. 487, pl. 24, fig. 10, 10 *a*—Strebel, Beitr. Mex. Land- und Süssw.-Conch. v, p. 63.—*Bulimus botterii* Pfr. Monogr. Helic. Vivent., viii, p. 61.—*Bulimus sulcosus*, form A (part), Strebel, loc. cit. p. 61, pl. 6, fig. 17; form B, p. 62, pl. 5, fig. 4 (*teste Martens*).—*Otostomus sulcosus* var. *botterii* Martens, Biol. Centr. Amer. Moll., p. 208.

Considered a variety of *D. sulcosus* by von Martens; but it seems to differ in the fine spiral sculpture, which is wanting in *sulcosus*.

D. sulcosus (Pfeiffer). Pl. 10, figs. 59, 60, 61, 62, 63.

Shell oblong-conic, perforate, solid and strong; opaque-bluish, or fleshy-white, frequently clouded longitudinally with reddish-brown on the spire, and sometimes showing faint traces of three wide bands on the last whorl. Surface lustreless, *deeply, coarsely and irregularly wrinkled*, the spire smoother, conic, apex with typical *Drymaeus* sculpture, whorls 6–$6\frac{1}{2}$, convex.

Aperture ovate or squarish-ovate, *pinkish-purple within*, moderately oblique; peristome blunt, whitish, somewhat expanded, columellar margin reflexed above; columella nearly straight above, and white, or with the parietal wall, purple-tinted.

Alt. $33\frac{1}{2}$, diam. 17, length of aperture 16 mill.

Alt. 42, diam. $17\frac{1}{2}$, length of aperture $20\frac{1}{2}$ mill.

*Central Mexico: near the city of Mexico* (Boucard, Hahn); *valley of Mexico* (Bourgeau); *Tacubaya* (Hegewisch); *summit of the Sierra de las Aguas Escondidas*, at an elevation of 9500 feet above the sea (H. H. Smith); *Tuxpan* (Strebel), *Soledad, State of Guerrero* (H. H.

Smith); *Mountains near Chilpancingo, Guerrero,* in pine and oak forest at 9500 feet elevation (E. W. Nelson).

*Bulimus sulcosus* Pfr. Symb. Hist. Helic., i. p. 43 (1841).—Philippi, Abbild. neuer Conch. i, p. 56, pl. 1, fig. 9—Pfr. Monogr. Helic. Vivent. ii, p. 196.—*Bulimus* (*Mesembrinus*) *sulcosus* Albers, Die Helic. ed. i, p. 157.—Pfr. in Malak. Blätt. ii, p. 158 (1855).—*Orthalicus* (*Mesembrinus*) *sulcosus*, H. & A. Adams, Gen. Rec. Moll. ii, p. 157.—*Bulimulus* (*Scutalus*) *sulcosus* Mart. in Albers' Die Helic., ed. 2, p. 217.—Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 520, pl. 23, fig. 2, 2 *a*, *b*.—*Otostomus* (*Scutalus*) *sulcosus* Mart. Conch. Mittheil. ii, p. 198; Biol. Centr. Amer., Moll., p. 208, pl. 13, f. 3, 3a, 4.—*Bulimus hyematus* Reeve, Conch. Icon. v, *Bulimus*, pl. 49, fig. 324 (1848).—*Bulimulus* (*Scutalus*) *sulcosus* var. a, *hiematus* Mart. in Malak. Blätt. xii, p. 33 (1865).

Very closely allied to *rudis* and *ghiesbreghti*, all of them characterized by the very strong folds of the last whorl. It is likely that the three may prove to be merely varying races of one species. In most specimens the columella and parietal wall are whitish, but in those above recorded from Soledad and Chilpancingo the upper portions of the columella and the parietal wall are deep purplish-rose, the other characters being typical. The interior of the aperture is purplish-rose in all of the specimens before me. Von Martens writes as follows: "All authors describe the aperture of this species as having a simple (not reflected) edge, but I can see in some specimens a very faint, but distinct, expansion of the edge outwards: in one of the examples collected by Mr. H. H. Smith it is quite strong and 2 mill. broad. The interior of the aperture is described as chocolate-colored: in the specimens collected by Uhde it is of a greyish rose-color, in those by Mr. H. H. Smith either rose-colored or pure white; the columella is in all of them white. The largest specimens, long. 44 mill., unicolorous, white, are from the summit of the Sierra de las Aguas Escondidas, 9500 feet, near Omilteme, in the State of Guerrero, collected by Mr. H. H. Smith."

D. rudis (Anton). Pl. 15, figs. 43–46; pl. 10, figs. 65, 66, 67.

Shell openly perforate, ovate-conic, sculptured with coarse, irregular growth striæ; a little shining; white, flamed and banded with brown and livid. Spire rather lengthened, the apex acute. Whorls $5\frac{1}{2}$, a little convex, the last inflated, as long as the spire. Aperture

oblong-oval, brownish [or white] inside, black-striated, shining; peristome acute, the columellar margin vaulted, dilated (*Pfr.*).

Alt. 23, diam. 13, length of aperture 12 mill.

Alt. 24½, diam. 13, length of aperture 12½ mill.

*Central Mexico: environs of the city of Mexico* (Hahn); *Chapultepec* (Hegewisch, Heilprin); *Angangues, State of Michoacan* (Deppe).

*Bulimus rudis* ANTON, Verz. d. Conch. Samml. p. 43 (1839).—PFR. Symb. Hist. Helic. ii, p. 50; Monogr. Helic. Vivent. ii, p. 197.—REEVE, Conch. Icon. v, *Bulimus*, pl. 44, fig. 286.—*Bulimus* (*Mesembrinus*) *rudis* ALBERS Die Helic. ed. i, p. 157.—PFR. in Malak. Blätt. ii, p. 158 (1855).—*Orthalicus* (*Mesembrinus*) *rudis*, H. & A. ADAMS, Gen. Rec. Moll. ii, p. 157.—*Bulimulus* (*Scutalus*) *rudis*, FISCH. & CROSSE, Miss. Scient. Mex., Mollusca, i, p. 523, pl. 23, figs. 6, 6a; pl. 22, figs. 7–11 (jaw, radula, anatomy).—*Bulimulus rudis* STREBEL, Beitr. Mex. Land- und Süssw.-Conch. v, p. 63, pl. 5, fig. 3; pl. 6, fig. 9.—*Otostomus* (*Scutalus*) *rudis*, MART., Conch. Mittheil. ii, p. 193.—*Bulimulus sulcosus*, form A, STREBEL, Beitr. Mex. Land- und Süssw.-Conch. v, p. 61, pl. 5, figs. 1, 2; pl. 11, figs. 12 a, b, 13, 14, 15; pl. 13, fig. 8 (radula).—?*Bulimulus* (*Scutalus*) *sulcosus*, var β. *fenestratus*, MART. in Malak. Blätt. xii, p. 34 (1865).—*Otostomus rudis* MART., Biologia p. 209.

The thinner, more ventricose shell, usually much less strong sculpture, and bold striping, distinguish this species from *D. sulcosus*. Of twelve specimens before me, two show three somewhat interrupted spiral bands in connection with the usual streaks; the others have longitudinal stripes or ragged streaks only. Figs. 43, 44 of pl. 15 are drawn from specimens from the gardens of Chapultepec, near the City of Mexico, collected by Heilprin's Mexican Expedition. They are very smooth for the species, being merely wrinkle-striate, and thin, almost fragile. Figs. 45, 46 are from specimens more like that illustrated by Fischer & Crosse. The blackish streaks vary from a dozen on the last whorl, to two or three, and may be either continuous or ragged and blotched.

D. GHIESBREGHTI (Pfeiffer). Pl. 15, figs. 32, 33; pl. 1, figs. 72–80.

Shell perforate, ovate-conic, solid, somewhat rugulose-striate, scarcely shining; white, ornamented with sparse brown streaks. Spire rather regularly conic, the apex somewhat acute, suture minutely serrulate. Whorls 6, the upper ones hardly convex, the last

about equal in length to the spire, more convex, slightly tapering at base. Columella lightly arcuate, lilac colored. Aperture slightly oblique, acuminate-oval; peristome simple, the right margin narrowly expanded, columellar margin vaulted, reflexed.

Alt. 31–32, diam. 13, length of aperture 16½ mill. (*Pfr.*)

*S. Mexico: Chiapas* (Ghiesbreght); *Tlacolula* (Höge).

*Bulimus ghiesbreghti* Pfr., in Malak. Blätt. xiii, p. 82 (1866); Novit. Conch. iii, p. 309, pl. 75, figs. 6, 7; Monogr. Helic. Vivent. vi, p. 46.—*Bulimulus* (*Scutalus*) *ghiesbreghti* Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i. p. 522, pl. 23, fig. 4.—*Bulimulus ghiesbreghti* Strebel, Beitr. Mex. Land- und Süssw.-Conch. v, p. 60, pl. 6, fig. 14.—*Otostomus ghiesbreghti* Mart., Biol. Centr. Amer., Moll., p. 209, pl. 13, f. 5–10 (with varieties).

The typical form of *D. ghiesbreghti* (pl. 15, figs. 32, 33), is rather smooth, and has narrow brown streaks. Von Martens recognizes the following varieties.

Var. *stolli* Martens (pl. 1, figs. 72, 73, 76, 77, 78). More rugose.

*Bulimulus* (*Scutalus*) *ghiesbreghti* Fisch. & Crosse, loc. cit., p. 522, pl. 23, fig. 4a.—*Bulimulus ghiesbreghti* Strebel, loc. cit. pl. 5, fig. 5.—*Bulimulus jonasi* var. *stolli* Mart., in Sitz.-Ber. Ges. Naturf. Freunde Berl. 1886, p. 161.—*Otostomus g. var. stolli* Mart., Biol. Centr. Amer. pl. 13, f. 5–8, 10.

*Central Guatemala: Llano of Quezaltenango*, at an elevation of from 6000 to 9000 feet above the sea, common, chiefly on *Agave*, and on various shrubs (Stoll); *Argieta, department of Solola*, in the "tierra fria" (Bocourt); *Los Encuentros*, at an elevation of 8000 feet, at *Tecpam* 7000 feet, also on the northern slope of the *Volcan de Agua*, in the belt of tall forest-trees, at from 8000 to 9000 feet, and at *Antigua* (Stoll). *W. Guatemala:* in the forest above the Hacienda de *Las Nubes*, on the southern slope of Cerro Zunil (Champion).

Var. *interstitialis*, Martens (pl. 1, fig. 75). Regular white or brownish longitudinal ribs, the intervals tawny on the last whorl; parietal wall of the aperture pale rose, columella white.

*Central Guatemala: Cumbre de San Martin*, on the N. W. slope of the Cordillera, at an elevation of 6000 feet (Stoll).

Var. *iodostylus* Pfr. (pl. 1, figs. 79, 80). Sculpture less strong.

*Bulimus iodostylus* Pfr. P. Z. S., 1861, p. 23; Malak. Blätt, xi, p. 13 (1864); Monogr. Helic. Vivent. vi, p. 48.—? *Bulimulus*

(*Scutalus*) *iodostylus* FISCH. & CROSSE, Miss. Scient. Mex., Mollusca, i, p. 539.—*Bulimus iodostylus* STREBEL, Beitr. Mex. Land- und Süssw.-Conch. v, p. 70, pl. 12, figs. 8*a*, 8*b*.

*S. W. Mexico: Santa Efigenia, Tehuantepec* (Sumichrast).

The variety *stolli* is so much like *D. sulcosus* as to suggest specific identity. Von Martens writes as follows: Dr. O. Stoll states, in his MS. notes, that this species is very common at the above-mentioned elevations, but apparently dees not occur on the most elevated ridges between Totonicapan and Tecpam, nor lower than 6000 feet on the terraces of the Cordillera at Santa Maria and San Martin. In dry weather it conceals itself on the lower face of blades of grass, but during and after rain it creeps about freely.

The relative proportion of the breadth to the length of the shell is very variable, as is also the size in this species. Its chief characteristics are the coarse plaits of the last whorl, the preceding whorls being remarkably smoother, and the rose-color of the apertural wall and of the columella. The last-mentioned character distinguishes it—with few exceptions—from *O. sulcosus*, which is the corresponding form in the elevated plain of Central Mexico. The rose color, however, is somewhat variable; it is never wanting, and more or less intense on the upper half of the columellar margin, and extends sometimes upwards on to the parietal wall and beneath to near the base of the aperture; in some specimens the whole interior of the aperture is pale rose-colored, and a stripe which on the outside is dark brown appears in the interior intense reddish-brown.

D. HEGEWISCHI (Pfeiffer). Pl. 1, figs. 81, 82, 83, 84, 85.

Shell ovate, thin but moderately strong, very narrowly perforate; whitish, usually stained in places with light brown, and having unequally spaced, narrow, brown longitudinal streaks which do not extend to the suture above, and are often obsolete at the base. Surface shining, irregularly wrinkle-striate, and showing fine, subobsolete spiral lines under the lens. Spire conic, the apex obtuse, with typical *Drymæus* sculpture; whorls $5\frac{1}{2}$, but slightly convex, the last oval.

Aperture long-ovate, light brown or yellowish inside, showing dark streaks; peristome thin and unexpanded, acute; columellar margin reflexed for a short distance above, nearly closing the perforation.

Alt. 25, diam. $12\frac{1}{2}$, length of aperture 14 mill.

*Central Mexico: environs of Mexico*, in tierra fria, on Cactus

(Sallé and Boucard); *San Antonio, near City of Mexico* (Heilprin Exped.); *Toluca* (Höge); *Cuernavaca* (Godman); *Puebla and Tehuacan* (Uhde); *Tenango* (*Hegewisch*).

? *Bulimus* (*Bulimulus*) *nitidulus* Beck, Index Moll., p. 67 (1838) (without description).—*Bulimus hegewischi* Pfr., Symb. Hist. Helic. ii, p. 46 (1842) (excl. var.); Monogr. Helic. Vivent. ii, p. 172.—Reeve, Conch. Icon. v, *Bulimus*, pl. 70, fig. 508.—*Bulimus* (*Mesembrinus*) *hegewischi* Albers, Die Helic. ed. i, p. 157—Pfr. in Malak. Blatt. ii, p. 158 (1855).—*Orthalicus* (*Mesembrinus*) *hegewischi*, H. & A. Adams, Gen. Rec. Moll. ii, p. 157.—*Bulimulus* (*Mormus*) *hegewischi* Martens in Albers' Die Helic., ed. 2, p. 216; Malak. Blatt. xii, p. 28 (1865).—*Bulimulus* (*Scutalus*) *hegewischi* Fischi. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 526, pl. 23, fig. 10, 10*a*, and var. minor, gracilior, f. 10*b*.—*Bulimulus hegewischi* Strebel, Beitr. Mex. Land- und Süssw.-Conch. v, p. 66, pl. 6, fig. 10.—*Otostomus hegewischi* Martens, Biol. Centr. Amer., p. 211, pl. 13, f. 14.

Var. *c*, yellowish, with numerous chestnut streaks.

*Bulimulus* (*Mormus*) *hegewischi* Var. e, Mart. in Malak. Blätt. xii. pp. 28, 29 (1865).—*Bulimulus hegewischi*, No. 2, Strebel, loc. cit. p. 67.

*E. Mexico: Orizaba* (Uhde).

Var. *d*, yellowish, with faint diaphanous streaks (fig. 82).

*W. Mexico, Omilteme, in the State of Guerrero* at an elevation of 8000 feet (H. H. Smith).

Differs from the foregoing species in the long, oval body-whorl and narrower perforation. Figs. 84 and 85 show this characteristic shape better than the others. The longitudinal stripes vary from many to very few and inconspicuous. Dr. von Martens writes: This species is about intermediate between *O. recluzianus* and *O. ghiesbreghti*, Pfr.; it is rougher than the former and not so coarsely wrinkled as the latter; the stripes are ordinarily not abrupt below, and the columellar margin is white. Of the var. *c*, I know of only two young specimens; their stripes break up at the same height, but perhaps in the adult shell this may be otherwise. It is strange that the vars. *c* and *d* should not have been found by other collectors, but I am unable to refer them to any other known Mexican species. I have already stated that the locality Pazquaro (Patzcuaro), state of Michoacan, is given in Pfeiffer's first description only for the variety $\beta$, "fasciis latis tesselatis violaceo-fuscis," which is probably my

*O. fenestrellus;* but in his other work it stands alone for the whole species, owing possibly to the unintentional omission of the locality Tenango. Neither Fischer and Crosse nor Strebel have noticed this.

D. JONASI (Pfeiffer). Pl. 10, figs. 64, 68, 69, 70, 71.

Shell perforate, oblong-conic, rather thin but moderately solid; shining, *white or buff*, with *numerous narrow longitudinal corneous or corneous-brown streaks, occupying the sulci between prominent, unequal wrinkles or folds of the surface;* rather slight and superficial spiral striæ appearing under the lens. Spire long, the apex obtuse, with typical *Drymæus* sculpture, whorls nearly 6, moderately convex, the last revolution of the suture deeply impressed.

Aperture long-ovate, colored within like the outside; peristome thin, acute, the outer lip moderately expanded in large individuals; columellar margin reflexed for a short distance above.

Alt. 26, diam. 11, length of aperture 12½ mill.

Alt. 24½, diam. 11, length of aperture 12 mill.

*Central Guatemala: Environs of the city of Guatemala* (Sallé, Stoll); *Antigua and Amatitlan* (Stoll); *Dueñas* (Champion). [? N. Guatemala: Vera Paz. (by error Vera Cruz) (Delattre); Coban (Salvin)]. *Costa Rica* (van Patten in Berlin Museum).

*Bulimus jonasi* PFR. in Philippi, Abbild. neuer Conch. ii, p. 125, pl. 5, fig. 4 (1846); Monogr. Helic. Vivent. ii, p. 107; in Martini & Chemnitz, Syst. Conch.-Cab., ed. 2, *Bulimus*, p. 168, pl. 50, figs. 11, 12.—DESHAYES, in Ferussac, Hist. Nat. Moll. Terr. ii, 2, p. 183, pl. 150, figs. 17, 18.—REEVE, Conch. Icon. v, *Bulimus*, pl. 55, fig. 363.—*Bulimus* (*Leiostracus*) *jonasi* PFR. in Malak. Blatt. ii, p. 153 (1855).—*Otostomus* (*Leiostracus*) *jonasi* H. & A. ADAMS, Gen. Rec. Moll. ii, p. 151.—*Bulimulus* (*Mormus*) *jonasi* MART. in Albers, Die Helic. ed. 2, p. 216.—BINNEY, Am. Journ. Conch. vii, p. 182 (1872) (jaw, radula).

*Bulimulus* (*Scutalus*) *jonasi* FISCH. & CROSSE, Miss. Scient. Mex., Mollusca, i, p. 525, pl. 23, figs. 7, 7a.—*Bulimulus jonasi* MART. in P. Z. S. 1875, p. 648; Jahrb. d. M. Ges. iii, p. 257.—O. STOLL, Guatem. Reisen, p. 53 (1886).—*Otostomus* (*Mormus*) *jonasi* MART. in Conch. Mittheil. ii, p. 193; Biol. Centr. Amer., Moll., p. 212, pl. 13, f. 11–13.—*Mormus jonasi* W. G. BINNEY, Ann. N. Y. Acad. Sci. iii, p. 123 (jaw and teeth).

*D. jonasi*, like the allied *ghiesbreghti*, varies a good deal in the

prominence of the fold-like sculpture. Four specimens before me collected by Morelet have three broad, continuous or interrupted, dark purple-brown bands (fig. 64).

D. AURIFLUUS (Pfeiffer). Pl. 1, figs. 86, 87.

Shell subperforate, ovate-conic, thin, pale whitish corneous, with numerous longitudinal brown streaks alternating with white ones of the same width or wider; surface glossy, nearly smooth, with faint growth-lines and extremely fine, close superficial spiral striae. Spire conic, whorls $5\frac{1}{2}$, slightly convex, the last tapering below.

Aperture long-ovate, striped within; peristome thin, acute and not expanded; columellar margin with a short, narrow reflection above.

Alt. $20\frac{1}{2}$, diam. $10\frac{1}{2}$, length of aperture $11\frac{2}{3}$ mill.

*E. Mexico: Jalapa* (Höge); *Mirador* (Berendt); *Cordova* (Sallé, Höge); *Plantation Toxpa* (*Tospan*) *near Cordova* (Berendt).—*S. Mexico: Yalalag*, near Villa Alta in the State of Oaxaca, on the eastern slope of the Cordiliera, in dense forest (Höge); *Juquila*, State of Oaxaca (Höge).

*Bulimus auriſluus* PFR. P. Z. S. 1856, p. 319, pl. 35, fig. 10; Monogr. Helic. Vivent. iv, p. 400; Novitat. Conch. iii, p. 420, pl. 95, figs. 13, 14.—*Bulimulus* (*Mormus*) *auriſluus*, MART in Albers Die Helic. ed. 2, p. 216.—*Bulimulus* (*Drymæus*) *auriſluus* FISCH. & CROSSE, Miss. Scient. Mex., Mollusca, i, p. 499, pl. 20, figs. 21, 22.—*Bulimulus auriſluus* STREBEL, Beitr. Mex. Land- und Süssw.-Conch. iv, pl. 6, fig. 14; v, p. 79.—*Otostomus auriſluus* MART., Biologia, p. 213.

"At first sight this species much resembles *O. jonasi;* in *O. auriſluus*, however, the yellow stripes are on the same level as the whitish ground, whereas in *O. jonasi* the pale brown stripes are placed in depressions between the elevated whitish plaits. The edge of the aperture is also distinctly expanded in *O. auriſluus*, but only in full-grown specimens. The locality, 'Vera Cruz,' quoted by Dr. Pfeiffer, is probably intended for the State of that name, not the town." (*Martens.*)

D. RECLUZIANUS (Pfeiffer). Pl. 1, figs. 92, 93, 94, 95.

Shell subperforate, subfusiform-oblong, rather smooth, delicately sculptured with close spiral lines; shining, opaque, flesh-colored, ornamented with wide, irregular chestnut and grayish-purple streaks.

Spire conic, the apex rather obtuse, suture white-margined. Whorls 6, a little convex, the last as long as the spire. Columella thin, lightly arcuate, somewhat twisted above. Aperture subvertical, oblong; peristome simple, acute, the columellar margin reflexed and subadnate above.

Alt. 30, diam. 12, length of aperture 16, width 7½ mill. (*Pfr.*)

*South Mexico: Chiapas* (Ghiesbreght). *Central Costa Rica: San José* (Pittier and Biolley); *La Uruca*, near San José, at an elevation of 1,100 metres above the sea (Biolley); *San Francisco de los Rios, also near San José*, on hedges which surround the plantations of coffee (Pittier).

*Bulimus recluzianus* Pfr. in Zeitschr. für Malak. 1847, p. 82; Monogr. Helic. Vivent. ii, 172, and iv, p. 468; and in Martini & Chemnitz, Syst. Conch. Cab. ed. 2, *Bulimus*, p. 119, pl. 36, figs. 5, 6.—Reeve, Conch. Icon. v, *Bulimus*, pl. 74, fig. 530.—*Bulimus* (*Oxycheilus*) *recluzianus* Albers, Die Helic. ed. i, p. 174.—*Bulimus* (*Mesembrinus*) *recluzianus* Pfr. in Malak. Blätt. ii, p. 159 (1855). *Orthalicus* (*Oxycheilus*) *recluzianus* H. & A. Adams, Gen. Rec. Moll. ii, p. 155.—*Bulimulus* (*Drymæus*) *recluzianus* Mart. in Albers' Die Helic., ed. 2, p. 212.—*Bulimulus* (*Scutalus*) *recluzianus* Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 510.—*Bulimulus recluzianus* Strebel, Beitr. Mex. Land- und Süssw.-Conch., v, p. 68, pl. 6, fig. 8.—*Otostomus recluzianus* Martens, Biologia, p. 213 (with "var. *lineolatus*").

The Costa Rica localities given above are for what von Martens calls var. *lineolatus*, identifying it with the species so named by Conrad. It is not, however, the true *lineolatus*, and may be called var. *martensianus*. Smaller, yellowish, the length of the aperture not exceeding the diameter of the shell.

Dr. von Martens further remarks: "The stripes of this species are very irregular; even in the same specimen some are near one another, and others have large intervals between them; often they are more greyish violet than brown, from being situated in a more internal layer of the shell, and covered by a thin whitish superficial coating. Ordinarily, the stripes break up at the same height at some distance from the umbilicus; in young specimens, as a general rule, they break up at the angularity in the middle of the whorl.

"The specimens from Costa Rica have generally a thinner and more yellow-colored shell, and the largest which I have seen from

that country is only 20 millim. long, perhaps not full grown. *O. roseatus*, Reeve, from Columbia, comes very near this species." (*Martens.*)

D. LINEOLATUS (Conrad). Pl. 1, figs. 90, 91.

Shell scarcely perforate, ovate-conic, thin but moderately solid; opaque white, somewhat more than the lower half of the last whorl tinted with light chestnut; striped longitudinally with dark purplish-chestnut, the stripes not reaching to the suture above, nor to the base below. Surface glossy, smooth, showing traces of an excessively fine, dense spiral striation in places. Spire rather short, conic, with slightly convex lateral outlines; apex obtuse; sutures but slightly impressed. Whorls $5\frac{1}{2}$.

Aperture oblong, decidedly exceeding half the total length of shell, and greater than the total diameter; subvertical, streaked inside; columellar margin reflexed and closely appressed above, pressed in at its insertion; columella cord-like, vertical and straight; outer lip a little and gently expanded.

Alt. 25, diam. 13, length of aperture 15, width within $7\frac{1}{2}$ mill.

Alt. 25, diam. 11.8, length of aperture 14, width within $6\frac{2}{3}$ mill.

*Volcan de Cartago, Central Costa Rica.*

*Bulimus lineolatus* CONRAD, Proc. Acad. Nat. Sci. Phila., viii, p. 42 (1855)—PFR. Monogr. Helic. Vivent. iv, p. 398.—not *Otostomus recluzianus var. lineolatus* Martens, Biol. Centr. Amer. Moll., p. 214.

The spire is decidedly shorter than in *D. recluzianus* Pfr., the aperture longer, produced at base, and with less arcuate outer lip, and the columella is cord-like, and almost perfectly straight and vertical. Description and figures are from the types in coll. A. N. S. P.

D. LIRINUS (Morelet). Pl. 1, fig. 96.

Shell nearly imperforate, oblong-fusiform, irregularly rugate-striatulate, very obsoletely decussated (under the lens) with inconspicuous transverse lines, thin, delicate, milk-white. Spire lengthened, the apex rather obtuse; suture impressed, whorls 6, a little convex, the embryonal $1\frac{1}{2}$ smooth, corneous, the last scarcely longer than the spire; columella spirally twisted, filiform, of the same color. Aperture acuminate-oblong, shining and white within; peristome

simple, the terminations separated, columellar margin a little expanded, reflexed and appressed, basal and outer margins acute.

Alt. 30, diam. 11, length of aperture 15½ mill. (*C. & F.*).

*N. Guatemala: San Luis de Peten* (Morelet).

*Bulimus lirinus* MOREL., Testac. Noviss. ii, p. 11 (1851).—PFR., Monogr. iii, p. 313; viii, p. 26.—*Bulimulus* (*Drymæus*) *lirinus* FISCH. & CROSSE, Miss. Scient. Mex., Moll. i, p. 494, pl. 20, f. 10.

D. CUCULLUS (Morelet). Pl. 1, figs. 88, 89.

Shell imperforate, oblong-ovate, thin, rather obliquely rugose-striate, milky-whitish, spire rather long, the apex rounded, rather obtuse; suture impressed. Whorls 4, convex, the embryonal 1½ smooth, hyaline, the last whorl large, ventricose, longer than the spire, somewhat attenuated at base. Aperture acuminate-ovate, within shining and colored like the outside; peristome simple, the margins joined by a rather thick white callus; columellar margin dilated, whitish; basal and outer margins acute.

Alt. 18, diam. 8, length of aperture 9½ mill. (*C. & F.*)

*Yucatan: Sisal*, on sandy ground (Morelet).

*Bulimus cucullus* MORELET, Test. Noviss. i, p. 9 (1849)—PFR. Monogr. Helic. Vivent. iii, p. 383; in Martini & Chemnitz, Syst. Conch. Cab. ed. 2, *Bulimus*, p. 217, pl. 60, fig. 11, 12.—*Bulimus* (*Leptomerus*) *cucullus* PFR. in Malak. Blatt. ii, p. 159 (1855).—*Bulimulus* (*Mormus*) *cucullus* MARTENS in Albers' Die Helic., ed. 2, p. 216.—*Bulimulus* (*Scutalus*) *cucullus* FISCH. & CROSSE, Miss. Scient. Mex., Mollusca, i, p. 519, pl. 20, fig. 11; with var. *gracilior*, loc. cit. p. 519, pl. 20, fig. 12.

The var. *gracilior*, pl. 1, fig. 88, is probably only an extreme individual variation rather than a true variety. It measures: alt. 17, diam. scarcely 7, length of aperture 9 mill.

### GROUP OF D. ATTENUATUS.

D. FENESTRELLUS (v. Martens). Pl. 2, figs. 1, 2, 3, 4, 5.

Shell minutely perforate, ovate-conic, thin but moderately strong; *white, with 4 or 5 broad interrupted bands composed of large square purple-brown spots;* the bands rarely subcontinuous, occasionally reduced to few spots or none by encroachment of the white streaks.

Surface glossy or dull, with inconspicuous wrinkles of growth, on the base decussated or scratched by impressed spiral lines. Spire conic, subacute, black-tipped in banded specimens. Whorls fully 6, moderately convex, the last ventricose. Aperture oblong-ovate, inside white with vivid chestnut spots; outer lip acute, white-edged, not expanded; columellar lip shortly reflexed above.

Alt. 26½, diam. 14, length of aperture 14 mill.

Alt. 24½, diam. 12½, length of aperture 12½ mill.

*Central Mexico: elevated plain of Mexico* (Uhde); *Matamoras Izucar, State of Puebla* (Boucard); *Puebla* (Berkenbusch); *Patzcuaro, State of Michoacan* (Hegewisch).

? *Bulimus hegewischi* var. β Pfr. Symb. Hist. Helic. ii, p. 46; Monogr. Helic. Vivent. ii, p. 173.—*Bulimulus* (*Scutalus*) *fenestrellus* Mart. in Monatsber. Akad. Wiss. Berl., 1863, p. 541; Malak. Blatt. xii, p. 35 (1865) (part).—Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 529.—*Bulimus fenestrellus* Pfr. Monogr. Helic. Vivent. vi, p. 144.—*Bulimulus fenestrellus* Strebel, Beitr. Mex. Land- und Süssw-Conch. v, p. 64, pl. 5, fig. 10b; pl. 13, fig. 5 (radula); pl. 14, fig. 6 A, B (anatomy).—*Bulimus gealei*, H. Adams, P. Z. S. 1867, p. 309, pl. 19, fig. 21.—Pfr. Monogr. Helic. Vivent. vi, p. 110.—*Bulimulus* (*Scutalus*) *gealei*, Fisch. & Crosse, loc. cit. p. 536, pl. 21, figs. 3, 3 a, b.—*Otostomus fenestrellus* Martens, Biol. Centr. Amer., p. 214.

More inflated than any form of *D. attenuatus*, with shorter aperture and smaller triangular columellar reflection.

Var. *subunicolor* Martens (pl. 2, fig. 5). White, with light chestnut bands showing only in the throat.

*Bulimulus* (*Mormus*) *hegewischi*, varr. c, d, Martens in Malak. Blatt. xii, pp. 28, 29 (1865).—*Bulimulus* (*Scutalus*) *gealei* var. β, Fisch. & Crosse, loc. cit. p. 536, pl. 21, figs. 3c, 3d.—*Bulimulus fenestrellus* var., Strebel, loc. cit. p. 65, pl. 5, fig. 10a.—*Otostomus fenestrellus* v. Martens Conch. Mittheil. ii, p. 193; var. *subunicolor* v. Martens, Biol., p. 215.

Dr. von Martens writes: The variety seems to be found in company with the banded specimens. In the disposition of the bands this species bears some resemblance to *Otostomus serperastrum* and even to *O. emeus;* but the sculpture is distinctly more coarse, the vertical striæ are somewhat more wrinkled and prominent, the spiral striæ are not so fine and crowded, but rather irregular and broad,

and, finally, the whole shell is more or less provided with small rounded impressions, which look as if they had been inflicted by blows from a hammer (malleated).

D. ATTENUATUS (Pfeiffer). Pl. 2, figs. 6–16.

Shell oblong-fusiform, thin but solid; white, with irregular purple-brown longitudinal blotched streaks, generally broken into spots; all markings sometimes lacking. Surface glossy, with inconspicuous growth-striæ and *very fine, dense, shallowly engraved spiral lines throughout.* Spire conic with slightly convex outlines, the apex obtuse. Whorls 6, the earlier ones yellowish; last whorl oblong, tapering below.

Aperture oblong, white or showing the markings inside; peristome very gently expanded, white, thin; the columellar margin reflexed above, *with an impression or groove at its insertion;* the *columella cord-like, with a long fold above.*

Alt. 30½, diam. 12½, length of aperture 16 mill.

Alt. 31½, diam. 13½, length of aperture 17 mill.

*E. Mexico: Vera Cruz* (coll. Cuming); *Orizaba* (Boucard, Botteri); *Cordova*, commonly, on orange-trees (Höge, Berendt); *Atoyac* (H. H. Smith); *Mirador* (Sartorius).

*Bulimus attenuatus* PFR., P. Z. S. 1851, p. 256; in Martini & Chemnitz, Syst. Conch. Cab. ed. 2, *Bulimus*, p. 83, pl. 30, figs. 9, 10; Monogr. Helic. Vivent. iii, p. 336 (not of Mousson, 1854).—*Bulimus* (*Liostracus*) *attenuatus* PFR. in Malak. Blatt. ii, p. 152 (1855).—*Bulimulus* (*Drymæus*) *attenuatus* VON MARTENS in Albers' Die Helic. ed. 2, p. 212.—FISCH. & CROSSE, Miss. Scient. Mex. Mollusca, i. p. 491, pl. 23, figs. 1, 1a.—*Bulimulus attenuatus* STREBEL, Beitr. Mex. Land- und Süssw.-Conch. v. pp. 79–81, pl. 5, figs. 7a, b (not full-grown), 8a, b, c; pl. 13, fig. 13 (jaw); pl. 5, f. 15 (white form).—*Otostomus* (*Drymæus*) *attenuatus* VON MARTENS Conch. Mittheil. ii, p. 192; Biol. Centr. Amer. p. 215, pl. 13, f. 15, 16.—*Bulimus Kefersteini* PFR., in Malak. Blätt. xiii, p. 82 (1866); Novit. Conch. iii, p. 310, pl. 75, fig. 8; Monogr. Helic. Vivent. vi, p. 53.

Specimens collected by W. M. Gabb in Costa Rica (locality not more exactly recorded) are somewhat thinner than Mexican specimens; see pl. 12, figs. 16, 17. Some of these shells look deceptively

like *D. papyraceus*, having quite the color and pattern of some forms of that Brazilian species.

*D. attenuatus* is closely allied to *D. costaricensis*, but differs somewhat in the pattern of coloring, and in being more elongated than the typical form of the latter species. Costa Rican specimens collected by Gabb practically efface this distinction, however, having the long form of *attenuatus* and the color-pattern of *costaricensis*. The spotless form (var. concolor Martens, pl. 2, fig. 14) occurs with the typically colored form.

Dr. von Martens writes: The brown stripes are nearly perpendicular, often interrupted near the suture, and ordinarily less numerous in the last whorl than in the preceding ones; in some specimens they are entirely wanting in the last whorl, these forming a transition to the white variety. In a few specimens the stripes become broader and look rather like those of *O. serperastrum* var. *paivanus;* but the shell is easily to be distinguished from that of *Otostomus serperastrum* by its more attenuated shape and the much thinner, conspicuously spirally-twisted columella. The apex of the shell and the inside of the aperture are in some specimens yellowish. The var. *pittieri*, from Costa Rica, differs in the shell being smoother and rather yellowish, the streaks not interrupted; it has the aperture formed exactly as in typical *attenuatus*.

Var. VARICOSUS Pfeiffer. (Pl. 15, figs. 36, 37; pl. 2, figs. 9–11). A little more ventricose; alt. 36–37, diam. 16–18, length of aperture 17–19 mill.

*Bulimus varicosus* PFR., P. Z. S. 1851, p. 256; in Martini & Chemnitz, Syst. Conch.-Cab. ed. 2, *Bulimus*, p. 83, pl. 30, figs. 7, 8; Monogr. Helic. Vivent. iii, p. 326.—*Bulimus kefersteini* var. *β*, PFR. Novit. Conch. iii, pl. 76, fig. 9.—*Otostomus attenuatus* var. *varicosus* MARTENS, Biologia, p. 216, pl. 13, f. 16.

Var. PITTIERI von Martens (pl. 2, fig. 16). Lightly striatulate and with scarcely noticeable spiral lines, yellow, shining, with continuous, undulating widely separated streaks. Long. 30, diam. 13, apert. long. 15, diam. 8 mill.

*Bulimus attenuatus* ANGAS, P. Z. S. 1879, p. 478.—*O. attenuatus v. pittieri* VON MART., Biologia, p. 216, pl. 16, f. 1.

*S. W. Costa Rica: Alto de Mano Tigre*, near Terraba, 690 metres above the sea (Pittier); *Central Costa Rica: Dota*, a high hill-region, south of San José (Gabb).

D. TRIMARIANUS (von Martens). Pl. 2, figs. 17, 18.

Shell rimate perforate, ovate-fusiform, rather thin, lightly striatulate, somewhat shining; white, usually painted with fragments of interrupted bands. Spire attenuated, rather acute, the apex pale. Whorls 7, a little convex; suture impressed, delicately and irregularly crenulated, the last whorl moderately attenuated at base. Aperture nearly vertical, less than half the total length of the shell, oval-oblong; peristome a little thickened, narrowly expanded, white; columellar margin nearly straight, a little thickened, reflexed, half covering the perforation (*Martens*).

Alt. 32, diam. 14, length of aperture 14½, breadth 7 mill.

Alt. 27, diam. 12, length of aperture 12½, breadth 7 mill.

* *N.-W. Mexico: Tres Marias Islands* (Forrer and Richardson).

*Otostomus trimarianus* v. MART., Biol. Centr. Amer., Moll., p. 216, pl. 13, f. 17 (August, 1893).

"This species almost forms a connecting link between *Otostomus attenuatus*, *O. serperastrum* and *O. pallidior* Sow. the latter from the Peninsula of Lower California; it resembles *O. attenuatus* but has not its thread-like, twisted, columellar margin. From *O. pallidior* it is distinguished by the less conical, in the last whorl much more oblong, form, the thinner shell, and the narrower aperture; from *O. serperastrum* also by the general shape of the shell. Some specimens are entirely white; others have more or less distinct traces of pale brown spots on the penultimate whorl arranged in four spiral rows, corresponding in position to those of *O. serperastrum* (the fifth and sixth being covered by the following whorl) but they do not extend over more than half the whorl in the spiral direction" (*Martens.*)

D. HEPATOSTOMUS (Pfeiffer). Pl. 2, figs. 23–27.

Shell perforate, subfusiform-oblong, rather solid, smoothish; white, marked sparsely with brown streaks. Spire conic, rather acute; suture submargined. Whorls 6, moderately convex, the last a little longer than the spire, somewhat tapering at base. Columella vertical, straightened. Aperture scarcely oblique, oblong, liver-colored inside, glossy; peristome white, the right margin narrowly expanded, columellar margin flat, broadly reflexed.

Alt. 32, diam. 13, length of aperture 17 mill. (*Pfr.*)

*S. Mexico: Tepanistlahuaca* (Boucard); *Juquila, State of Oaxaca* (Höge).

*Bulimus hepatostomus* Pfr. P. Z. S. 1861, p. 23, pl. 3, fig. 4; Malak. Blätt. viii, p. 13 (1861); Monogr. Helic. Vivent. vi, p. 43.—*Bulimulus* (*Drymæus*) *hepatostomus* Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 493, pl. 21, fig. 2, 2*a*.—*Otostomus hepatostomus* Martens, Biol. Centr. Amer. Moll., p. 217, pl. 13, f. 18–20.

"Nearly allied to *O. attenuatus*, but less attenuated, also somewhat variable in form. The brownish hue of the inside of the aperture is in some specimens very distinct, in others scarcely to be seen. On the outside of the second half of the last whorl the shell becomes in some examples rather wrinkled." (*Martens.*)

D. costaricensis (Pfeiffer). Pl. 2, figs. 19, 20 (21, 22).

Shell perforate, ovate-fusiform, rather solid, irregularly striate, whitish, painted with interrupted or serrate streaks of buff and light red. Spire conic, the apex rather acute, corneous. Whorls 5, scarcely convex, the last three-fifths the total length of the shell, more inflated, having a prominent varix in the middle, tapering at base; columella compressed, thread-like, slightly twisted. Aperture subvertical, oblong-oval; peristome simple, narrowly expanded.

Alt. 23, diam. 11, length of aperture 14½ mill. (*Pfr.*)

Alt. 31½, diam. 18½, length of aperture 16 mill. (*Martens.*)

*Central Costa Rica: San José* (Pittier and Biolley); *San Francisco de los Rios*, near San José, on hedges (Pittier); *Alajuela*, at an elevation of 900–1000 metres above the sea (Orosco); *Cartago and Navarro* (*Boucard*); *elevated plain of Costa Rica* (Hoffmann).

*Bulimus costaricensis* Pfr. in Malak. Blätt. ix, p. 153 (1862); Monogr. Helic. Vivent. vi, p. 47; Novit. Conch. iii, p. 419, pl. 95, figs. 11, 12.—Angas, P. Z. S. 1879, p. 478.—*Bulimulus* (*Drymæus*) *costaricensis* Paetel, Catalog, p. 100.—*Otostomus costaricensis* Martens, Biol. Centr. Amer. p. 217.—*Bulimus navarrensis* Angas, P. Z. S. 1878, p. 73, pl. 5, figs. 15, 16.

"Very near *Otostomus attenuatus* and *O. hepatostomus*, but less attenuated, and with the stripes more interrupted, appearing in the upper whorls rather like interrupted spiral bands. Rather variable in size and proportional breadth: see the measurements given under the description above. Most of the specimens I have seen are somewhat more elongated and less ventricose than Pfeiffer's original type; but there are many gradations in this respect.

"Dr. Pfeiffer received his specimen of this species from Dr. von der

Busch, in Bremen, with the statement that it came from Costa Rica. The Berlin Museum received examples of it many years ago from Mr. Carmiol, who travelled in Costa Rica, but he could not give the locality more definitely. Dr. Gabb has also reported it from the same country, without nearer indication." (*Martens.*).

The specimens collected by Gabb are intermediate between *costaricensis* and *attenuatus*, but in my opinion referable to the latter. See pl. 12, figs. 16, 17.

*B. navarrensis* Angas (pl. 2, figs. 21, 22) is referred to *costaricensis* as a synonym by Dr. von Martens.

D. PLUVIALIS (Pfeiffer). Pl. 3, figs. 28, 29.

Shell subperforate, oblong-turrited, rather solid, rudely rugose-striate; whitish, painted with linear rufous streaks which are zigzag on the penultimate whorl. Spire elevated-conic, the apex rather acute, buff; whorls nearly 6, a little convex, the last a little shorter than the spire, obsoletely subcompressed at base. Columella arcuate, thread-like. Aperture little oblique, elliptical; peristome simple, unexpanded, the columellar margin narrowly reflexed.

Alt. 22, diam. 9½, length of aperture 11½ mill. (*Pfr.*)

*Costa Rica* (von d. Busch).

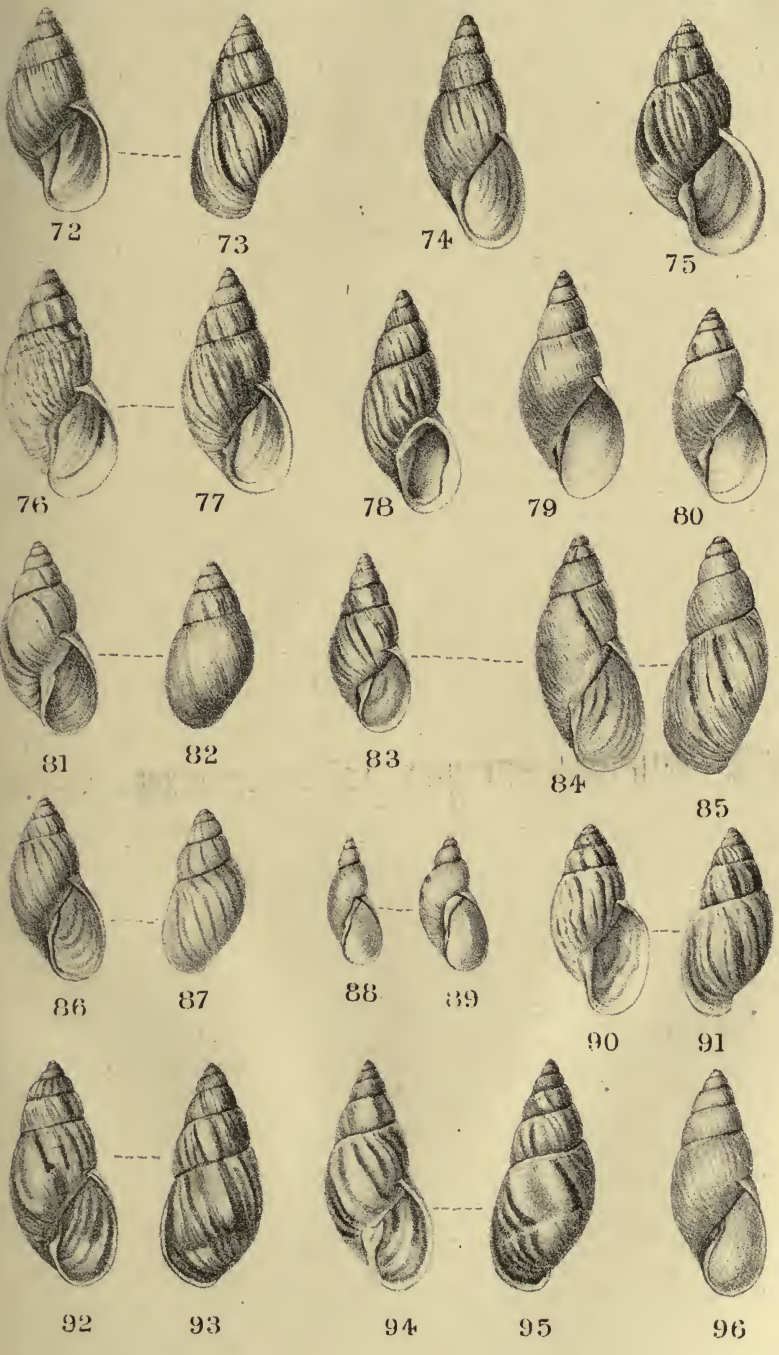
*Bulimus pluvialis* PFR., in Malak. Bl. ix, 1862, p. 153; Monogr. vi, p. 115; Novit. Conch. iii, p. 423, pl. 96, f. 5, 6.—*Otostomus pluvialis* MARTENS, Biologia Centr. Amer., p. 218.

Differs from *D. costaricensis* in the peristome not being expanded and in the more numerous linear brownish streaks.

D. BUGABENSIS (von Martens). Pl. 3, figs. 34, 35.

Shell subimperforate, oblong-fusiform, rather thin, lightly striatulate, shining, yellow, painted with rather wide black, flexuous streaks, mostly short above. Spire conic, the apex rather obtuse, colored like the shell or whitish. Whorl 6, a little convex, the last perceptibly attenuated at base. Aperture half the length of the shell, subperpendicular, ovate-oblong, colored within like the outside; peristome slightly expanded, the columellar margin somewhat thickened, distinctly twisted. Alt. 27, diam. 11, length of aperture 7½? mill. (*Mart.*).

*S. Panama: Bugaba, Department of Chiriqui*, at an elevation of 1000 ft. (Champion).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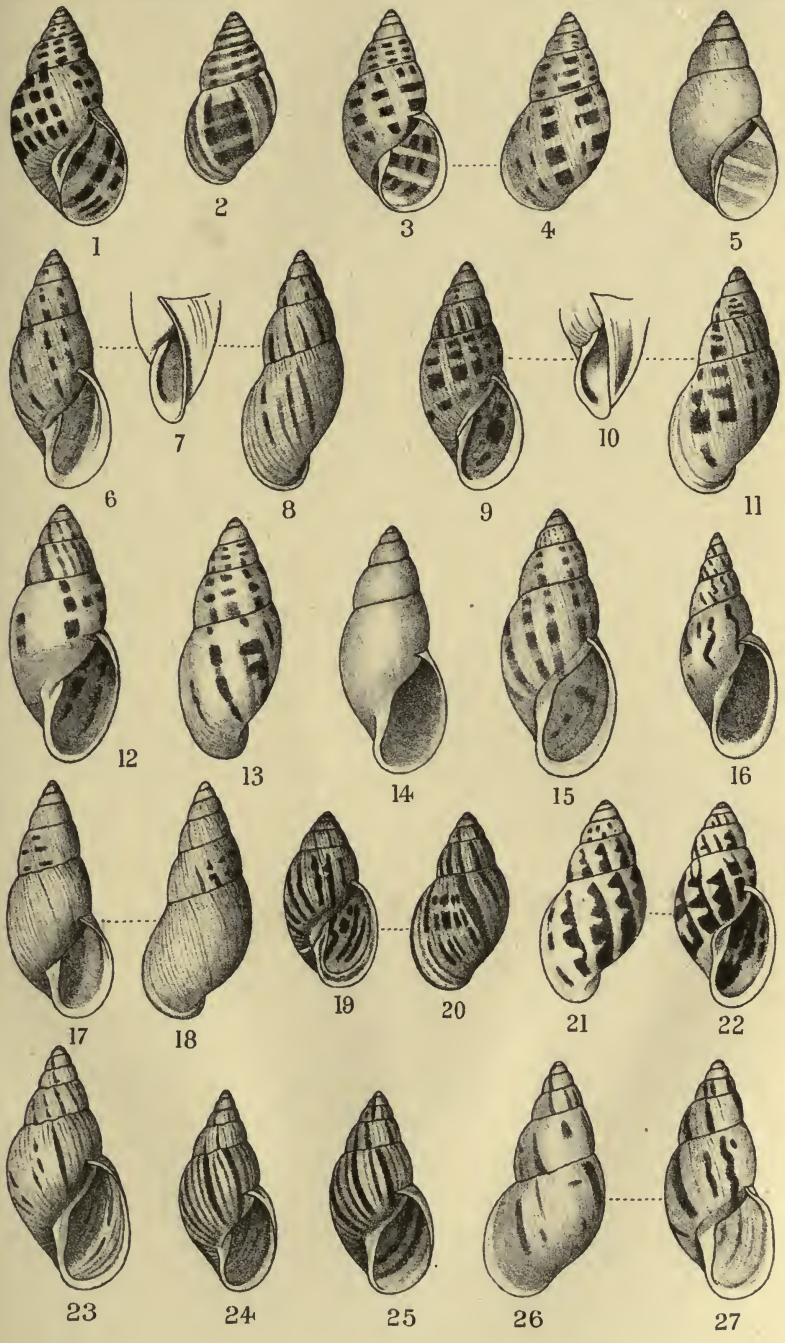
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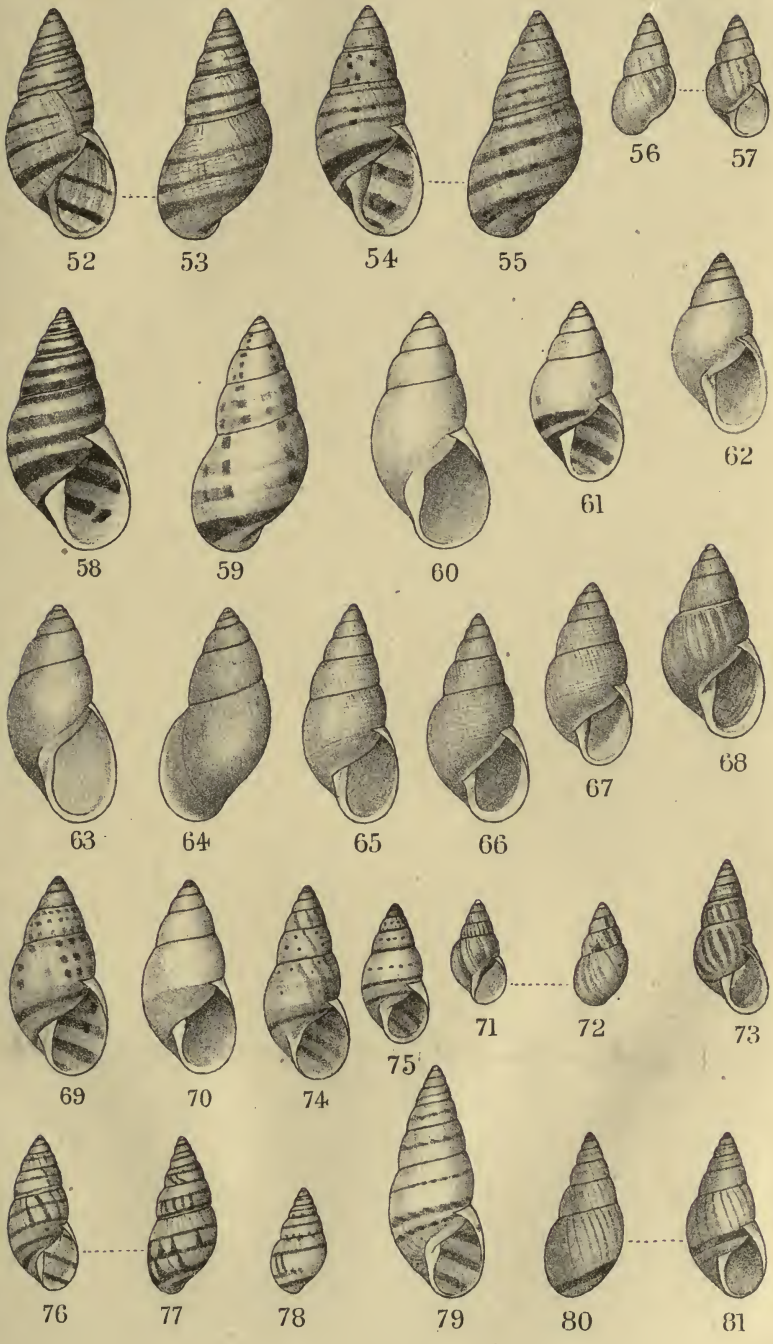
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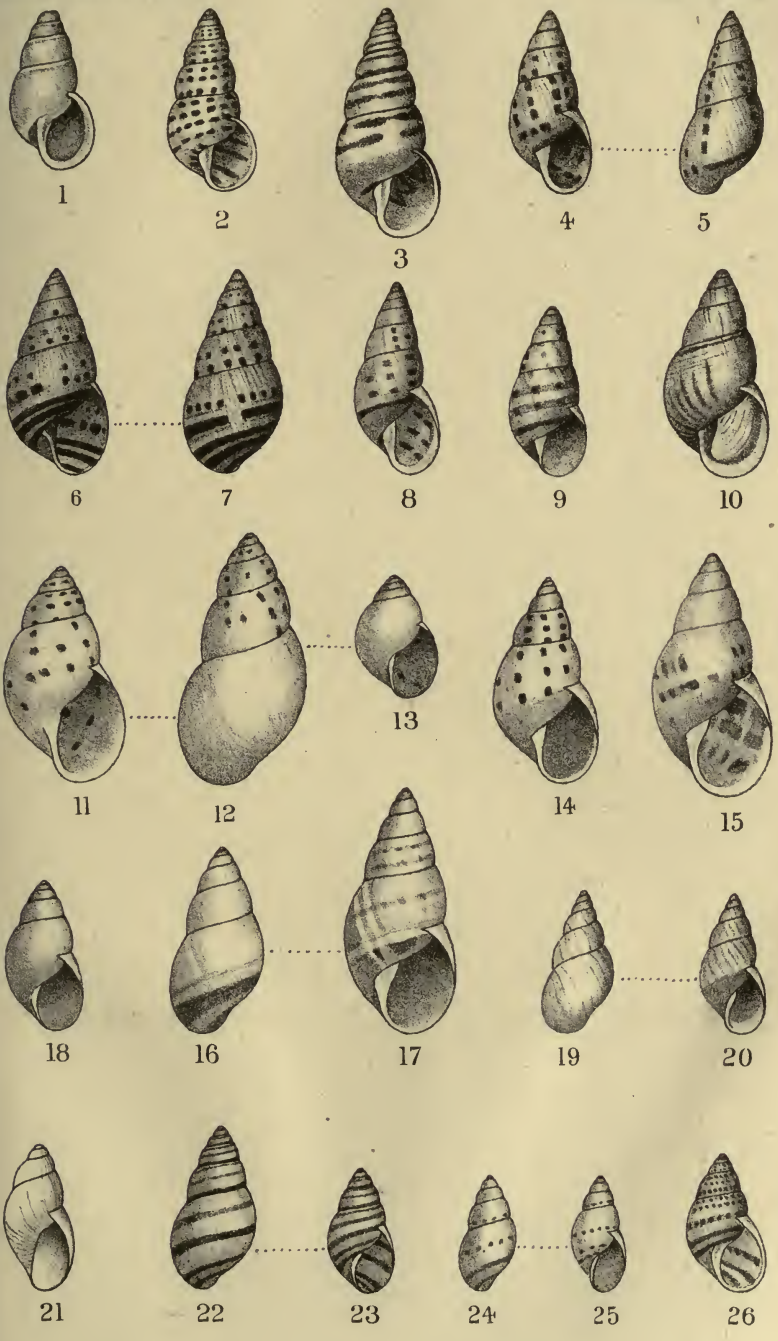
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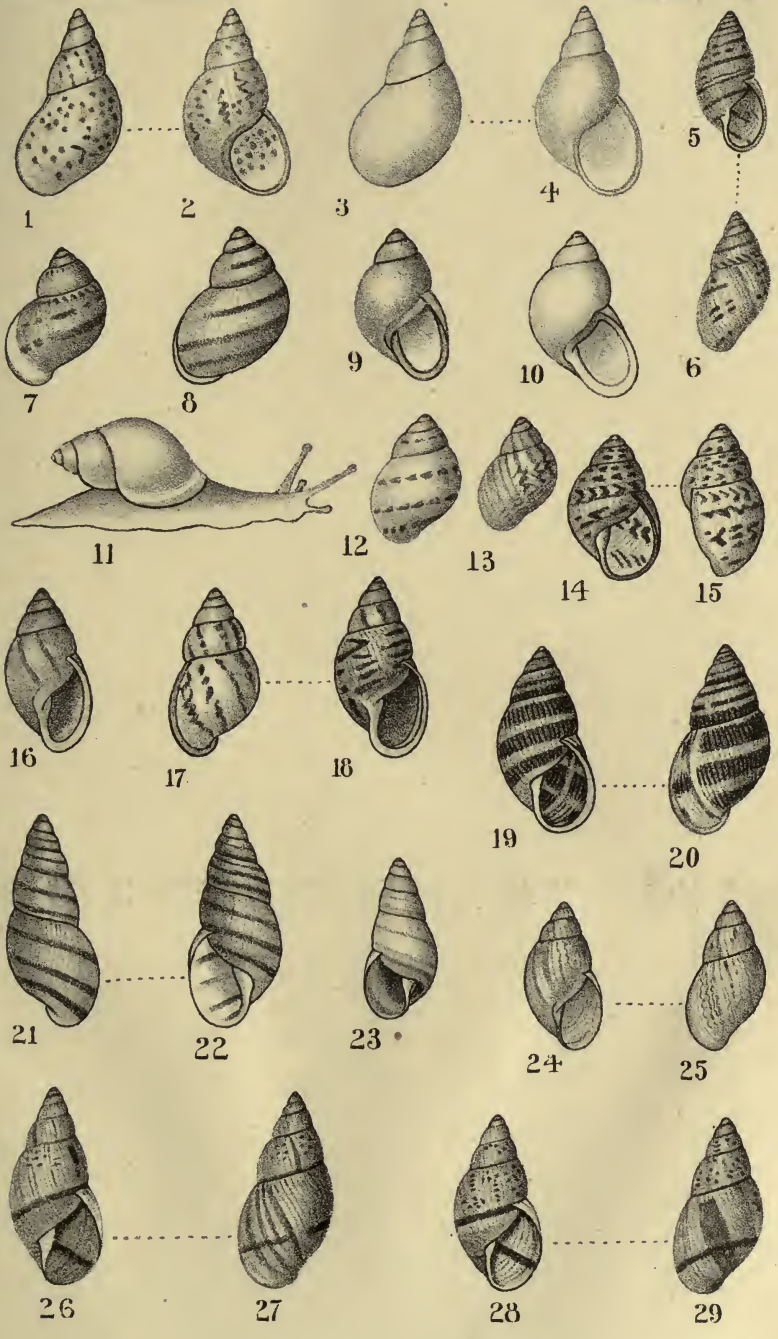
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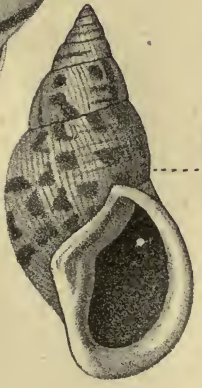

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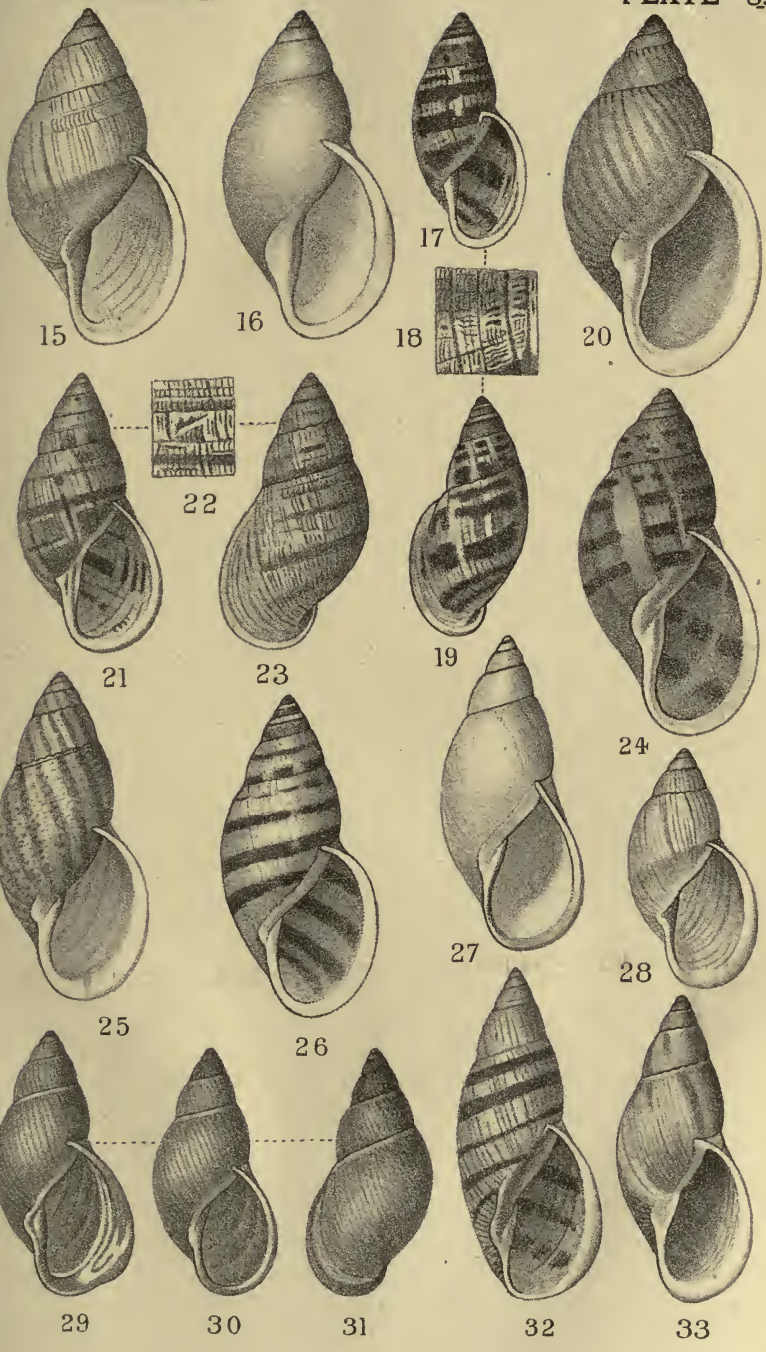
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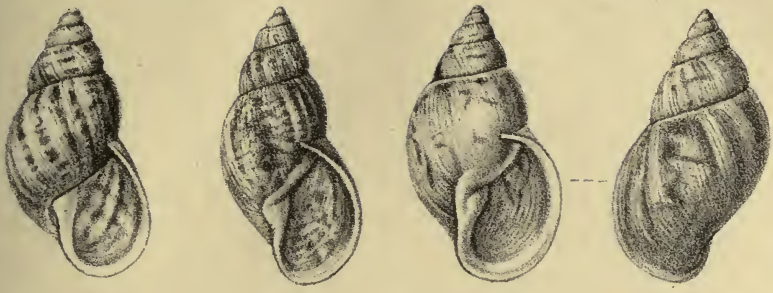

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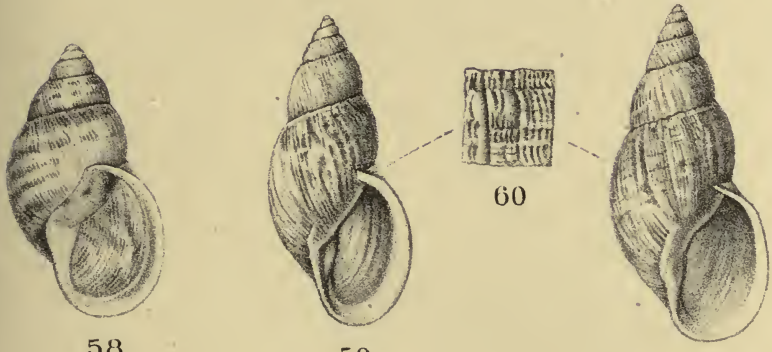

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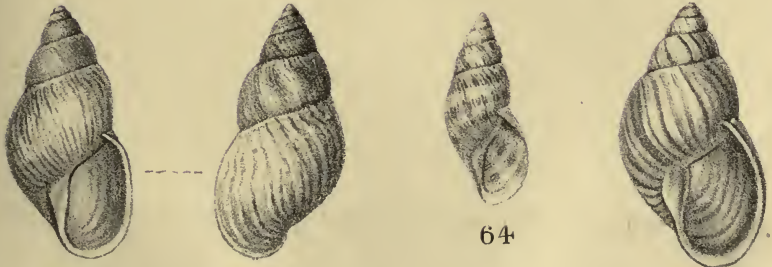

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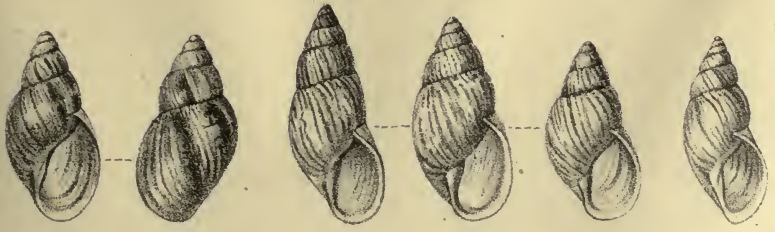

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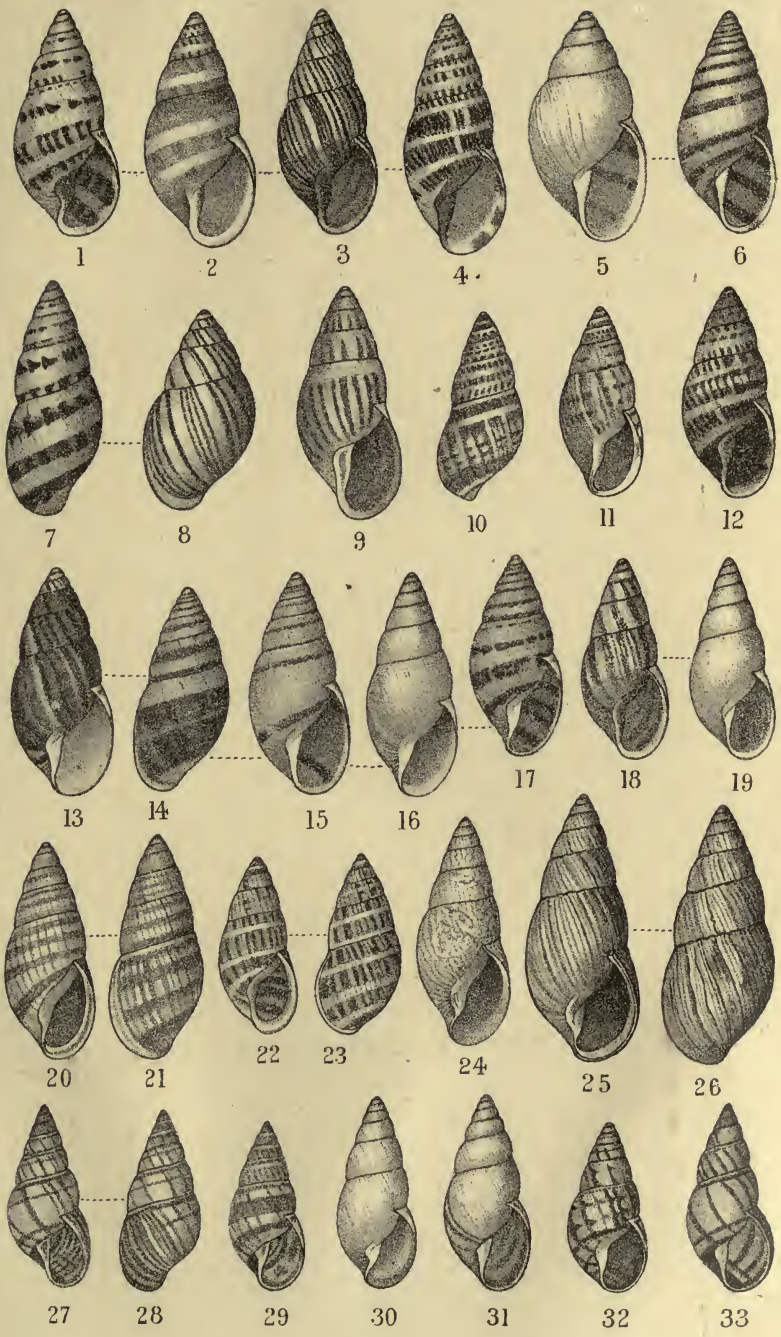
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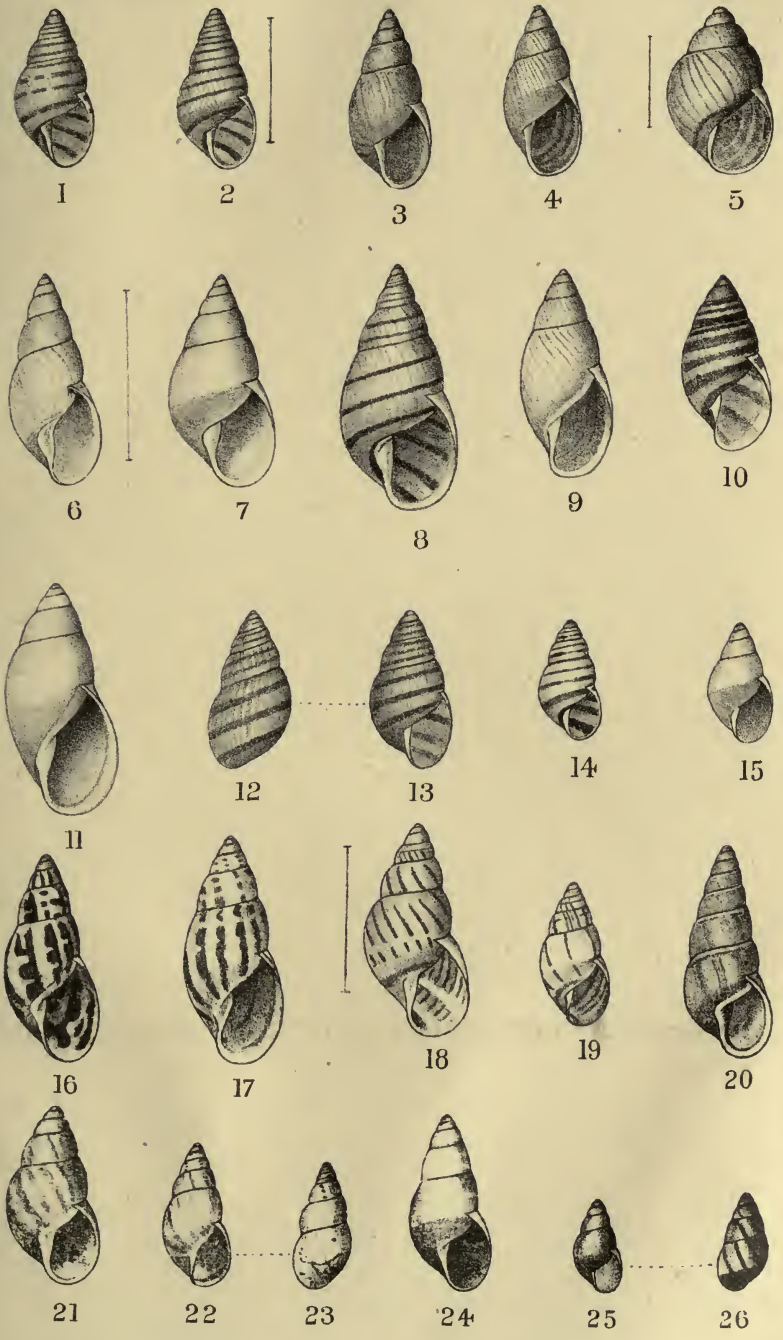
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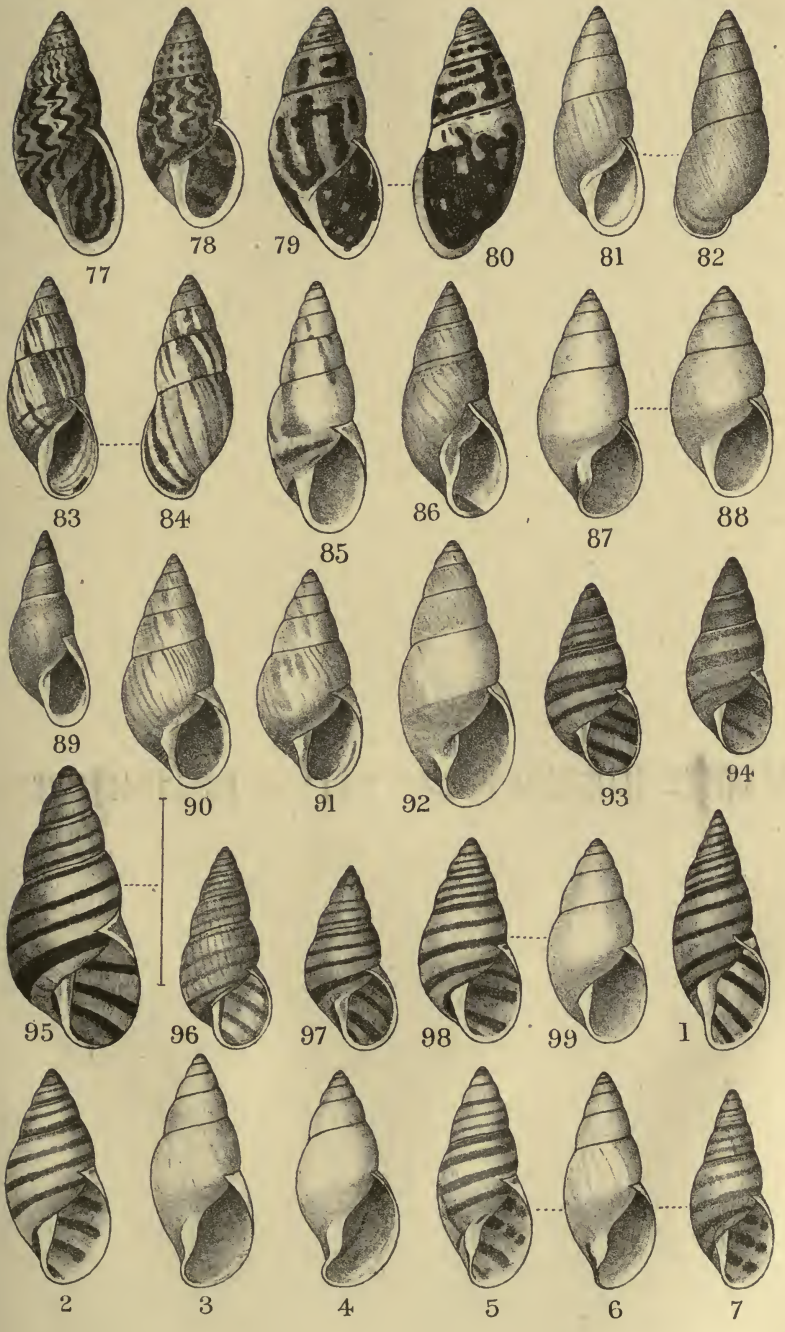
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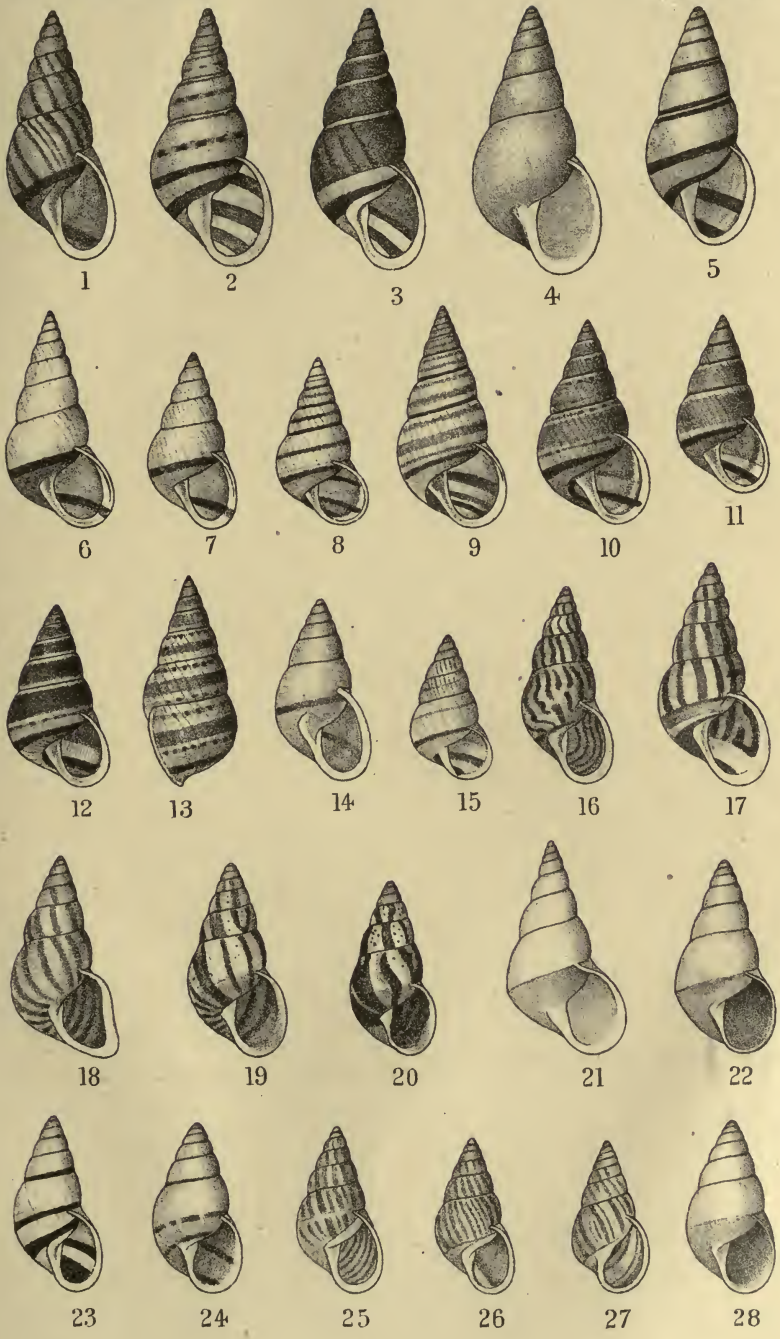
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*Otostomus bugabensis* von MARTENS, Biol. Centr. Amer., Moll., p. 218, pl. 13, f. 21, 21a (Sept., 1893).

The two specimens obtained have the aperture damaged, but I cannot refer them to any known species (*Martens*).

D. SARGI (Crosse & Fischer). Pl. 3, figs. 30, 31, 32, 33.

Shell scarcely rimate, oblong-ovate, thin, a little shining, nearly smooth, with rather distant, obsoletely rugulose, scarcely perceptible striæ; dull whitish, painted with transversely interrupted dark blackish-brown streaks and spirally-arranged series of spots. Spire conic, the apex rather obtuse, suture somewhat irregularly impressed. Whorls $5\frac{1}{2}$, moderately convex, the embryonal first $1\frac{1}{2}$ smooth, livid brownish-white; the last whorl a little longer than the spire (as 12 : 10), inconspicuously submargined at the suture, painted with twice interrupted longitudinal streaks and three spiral series of spots, sometimes confluent, lost on the base and toward the lip. Aperture acuminate-ovate, dull whitish inside, showing the bands and spots through; peristome simple, whitish, the margins joined by a very thin callus; columellar margin twisted inside, outwardly dilated, almost completely closing the umbilical chink; basal and outer margins a trifle expanded.

Alt. 22, diam. 10, length of aperture scarcely 12 mill. (*C. & F.*)

*Northern Guatemala: Tamahu* (*Sarg*).

*Bulimulus sargi* CROSSE & FISCH., in Journ. de Conch., xxiii, p. 52 (1875).—*Bulimulus* (*Scutalus*) *sargi* FISCH. & CROSSE, Miss. Scient. Mex., Mollusca, i, p. 534, pl. 24, fig. 6, 6a.—*Bulimus sargi* PFR., Monogr. Helic. Vivent., viii, p. 59.—*Otostomus sargi* MARTENS, Biologia, p. 218, with var. *motaguæ*, pl. 14, f. 2, 2a.

"Distinct from its allies by the smaller size, and the dark, almost completely black, stripes on a white ground" (*Mart.*)

Var. *motaguæ* Martens (pl. 3, figs. 32, 33). Smaller, the streaks more distinct, straight, wanting on the upper whorls.

Alt. 19–$21\frac{1}{2}$, diam. $8\frac{1}{2}$, length of aperture 11 mill. (*Mart.*)

*Central Guatemala: Valley of the Rio Motagua* (Stoll).

D. DROUETI (Pfeiffer). Pl. 3, figs. 36–43.

Shell nearly covered perforate, ovate conic, thin, rugulose-striate (very obsoletely decussated with spiral striæ); pale straw-colored, typically marked with five reddish-chestnut interrupted bands formed

by the transverse coalescence of blotches on longitudinal streaks, but varying considerably in development of bands or streaks; spire conic, rather acute. Whorls 6, slightly convex, the last slightly longer than the spire.

Aperture oblique, ovate; peristome thin, a trifle expanded, the columellar margin dilated above, abruptly reflexed; columella narrow.

Alt. 24, diam. $10\frac{1}{2}$, length of aperture 13 mill.

*E. Mexico: Pacho, Molino de Pedreguera, Coatepec, Chirimoyo,* all near Jalapa, and *Barranca de Mahuistlan, and San José Miahuatlan* (Strebel); *Jalapa* (Höge); *Mirador* (Berendt); *Orizaba* (Botteri, Sallé); *Cordova* (type locality, Sallé, Höge); *Plantation Toxpa* (*Tospan*), near Cordova (Berendt), *Atoyac* (Höge).

*Bulimus droueti* Pfr., P. Z. S., 1856, p. 319, pl. 35, f. 12; Monogr. Helic. Vivent. iv, p. 399.—*Bulimulus* (*Scutalus*) *droueti* Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i. p. 533, pl. 23, figs. 9, 9a, b.—*Bulimulus droueti* Strebel, Beitr. Mex. Land- und Süssw.-Conch. iv, pl. 6, fig. 13; v, p. 77, pl. 6, fig. 6. (young); pl. 12, figs. 7a, b, c.—*Bulimus sporlederi* Pfr., Malak. Blatt. xiii, p. 83 (1866); Monogr. Helic. Vivent. vi, p. 112.—*Bulimulus* (*Scutalus*) *sporlederi* Fisch & Crosse, Miss. Scient. Mex., Mollusca, i, p. 535, pl. 21, figs. 5, 5a.—*Bulimulus sporlederi* Strebel, Beitr. Mex. Land- und Süssw.-Conch. iv, pl. 6, fig. 12; v, p. 78, pl. 12, fig. 9; pl. 13, fig. 10 (radula); pl. 14, fig. 18A, B, C (anatomy).—*Otostomus* (*Scutalus*) *sporlederi* v. Mart., Conch. Mittheil. ii. p. 193.—*Otostomus droueti* v. Mart., Biologia, p. 218.

The coloration described above is that of Pfeiffer's type, the specimen used being from Mirador, which is also the type locality of *sporlederi*. Dr. von Martens enumerates the following color-forms.

*a:* (Typical form, pl. 3, figs. 36, 37, 38, 43). Streaks and spiral bands in combination. (Pfr. P. Z. S., 1856, pl. 35, fig. 12; Fisch. & Crosse, loc. cit. pl. 23, figs. 9, 9a; Strebel, loc. cit. iv, pl. 6, fig. 13; v, pl. 12, fig. 7*b*.)

*b:* Streaks rather numerous and wavy. (Strebel, loc. cit. iv, pl. 6, fig. 12; v, pl. 12, figs. 7*a*, 7*c*.)

*c:* (Var. *sporlederi*, pl. 3, figs. 40, 41, 42). Streaks fewer, straight, oblique (Fischer & Crosse, loc. cit. pl. 23, fig. 9*b*, *droueti*, var. $\gamma$.)

"The vars. *a* and *b* have been procured together at Cordova by Herr Höge, the var. *b* only at Atoyac by the same collector. The

var. *d* is only known from Orizaba. The var. *c* (*sporlederi*) is perhaps also distinguished by somewhat more flattened whorls, but in this respect there is also much variation in vars. *a* and *b*. Pfeiffer has placed his *Bulimus sporlederi* far apart from *B. droueti* in another sub-division, because his specimen was not full-grown and had therefore the peristome quite straight, whereas in adult specimens it is a little expanded, though always very thin."

D. INGLORIUS (Reeve). Pl. 3, figs. 44–52.

Shell perforate, ovate-conic, rather solid. Striate, obsoletely granulated by impressed spiral lines; dull white, painted with narrow, brown, white-dotted streaks. Spire conic, rather acute. Whorls 5½, a little convex, the last slightly exceeding the spire in length, rounded at base. Columella somewhat straightened. Aperture little oblique, oblong-oval; peristome simple, unexpanded, the columellar margin dilated above, vaulted, reflexed.

Alt. 26, diam. 12, length of aperture 14 mill. (*Pfr.*).

*S. Mexico: Juquila, State of Oaxaca* (Höge).

*Bulimus inglorius* REEVE, Conch. Icon. v, *Bulimus*, pl. 55, fig. 368 (1848).—PFR., Monogr. Helic. Vivent. iii, p. 419. *Bulimus* (*Mesembrinus*) *inglorius* PFR., Malak. Blatt. ii, p. 159 (1855).—*Otostomus inglorius* MARTENS, Biol. Centr. Amer., Moll., p. 219.

The typical form (pl. 3, fig 46) "has only a few scattered brown stripes, ornamented by white dots; but the var. *heynemanni* is very richly painted with broad black stripes on a ground which is whitish on the upper whorls and becomes more and more ochraceous-yellow towards the lower half of the last whorl. The stripes often include small pure white round spots, or are jagged on the side towards the aperture, sometimes projecting two or three branches in that direction, which, if they are repeated in the following stripes, may form three broad interrupted spiral bands. All the stripes break off at the same distance from the umbilicus. Inside the aperture the black stripes are quite as conspicuous as on the outside. In Dr. Pfeiffer's monograph, *Bulimus heynemanni* Pfr., and *B. inglorius* Reeve, are somewhat widely separated, the former in § 49, "subperforati vel obtecte perforati," and the latter in § 54, "perforati vel umbilicati." The umbilicus is always minute, but in some specimens cleft-like, oblong; in others from the same locality, similar in all other respects, it is nearly circular. Strebel has already suggested the identity of

*B. heynemanni* and *B. inglorius*, and after having examined a considerable number of specimens collected by Herr Höge, I quite agree with him." (*Martens.*)

Var. *heynemanni* (Pfr.). Pl. 3, figs. 44, 45, 47–52.

Boldly marked with wide, irregular black-brown stripes.

*E. Mexico: Orizaba* (Botteri). *Central Mexico: Tecomavaca*, in the State of Puebla, S. E. of Tehuacan, *Cactus-* and *Mimosa*-region (Höge). *S. Mexico: Cerro de San Antonio de la Cal*, in the State of Oaxaca, on shrubs (Boucard); *Tlacolula*, in the same State, copiously (Höge).

*Bulimus heynemanni* PFR., Malak. Blätt., xiii, p. 83 (1866); Monogr. Helic. Vivent., vi, p. 110; Novit. Conch., iii, p. 423, pl. 96, fig. 3, 4.—*Bulimulus* (*Scutalus*) *heynemanni* FISCH. & CROSSE, Miss. Scient. Mex., Mollusca, i, p. 527.—*Bulimulus heynemanni* STREBEL, Beitr. Mex. Land- und Süssw. Conch. v, p. 68, pl. 6, fig. 7.—*Bulimulus* (*Scutalus*) *inglorius* FISCH. & CROSSE, loc. cit., p. 538, pl. 21, fig. 9, 9a (not of Reeve).—*O. inglorious var. heynemanni* MARTENS, Biologia, p. 220, pl. 14, f. 1, 1a, 4, 4a.

### GROUP OF D. TRIPICTUS.

D. IRAZUENSIS (Angas). Pl. 6, figs. 16–20, 24, 25.

Shell somewhat elongately ovate, rimate, moderately thin, longitudinally irregularly striated, shining, more or less longitudinally striped or freckled with black, and ornamented with numerous small white spots; whorls 6, rather convex. Spire a little shorter than the aperture. Aperture oblong-ovate; lip thin, simple, tinged inside with rose color.

Alt. 25, diam. 12½ mill. (*Angas.*)

*Central Costa Rica: Volcan de Irazu*, on low aromatic bushes on the eastern slope (Boucard); Tierra Blanca, on the southern slope of the Volcàn de Irazu, at an elevation of 1800 metres above the sea (Biolley).

*Bulimus irazuensis* ANGAS, P. Z. S., 1878, p. 73, pl. 5, fig. 17–20. —*Otostomus irazuensis* VON MART., Biol. Centr. Amer., p. 224, pl. 14, f. 12, 12a, 13, 13a.

The following principal color-patterns occur:

*a.* More or less numerous zigzag stripes (figs. 17, 18).

*b.* Pale brown, sprinkled with white dots (figs. 16, 24, 25).

*c.* Three rather wide brown, white-spotted bands (figs. 19, 20).

"The varieties *a* and *b* have been procured in company, together with specimens approaching to *c* (see fig. 16), both by Boucard and Biolley, on the slopes of the Volcan de Irazu. Of var. *c*, I know of only one specimen, here figured, found among those collected by Van Patten: in one of his examples the peristome is slightly expanded.

"This species agrees with *O. tripictus* in having a rose-colored, simple peristome, but differs from it in the more elongate form and the rougher sculpture of the shell, also in the style of painting." (*Martens.*)

D. TRIPICTUS (Albers). Pl. 6, figs. 12, 13, 14, 15.

Shell very narrowly perforate, ovate, *ventricose*, thin; white or yellowish-white, with *three to five brown girdles elaborately figured with white*, or reduced to bands of arrow-shaped spots; *sometimes bandless, longitudinally streaked and more or less variegated with oblique, zigzag whitish lines.* Surface glossy, striatulate, without spiral striæ. *Spire short*, conic, the apex obtuse, with typical *Drymæus* sculpture. Whorls $4\frac{3}{4}$, rather convex, the last ventricose.

Aperture large, oblique; peristome thin, not expanded, *bordered inside and out with pink; columella pink, slender*, subvertical, more or less concave, the edge shortly reflexed above.

Alt. 20, diam. 13, length of aperture $12\frac{1}{2}$ mill.

Alt. 17, diam. 11, length of aperture $10\frac{1}{2}$ mill.

*Costa Rica* (Coll. Mousson, Carmiol, Gabb).

*Bulimus tripictus* ALBERS, in Malak. Blätt. iii, p. 97 (1857)—PFR., Monogr. Helic. Vivent. iv, p. 468.—VON MARTENS, in Jahrbücher d. deutschen Malak. Ges., iii, p. 256.—ANGAS, P. Z. S., 1879, p. 478.—*Otostomus tripictus* MARTENS, Biol. Centr. Amer., p. 225, pl. 14, f. 11, 11a (var. *hoffmanni*).—*Bulimulus rhodotrema*, VON MART., in Malak. Blätt. xv, p. 156 (1868); see also Jahrb. d. M. Gesell. iii, p. 256 (1876).—*Bulimus rhodotrema* PFR., Novit. Conch. iii, p. 463, pl. 101, fig. 10, 11; Monogr. Helic. Vivent. viii, p. 146.

Easily recognized by its globose form, roseate peristome and the complicated pattern of the bands, which are cut into spots or figures of very irregular and various shapes by oblique or zigzag lines or dots, in endless variety of design. Often the bands, typically five in number, are reduced to three by loss of the upper and lower ones, or their coalescence with the adjacent bands; and sometimes they are re-

duced to simple rows of spots (fig. 12). In other specimens, bands are wanting; inconspicuous or distinct corneous-brown streaks, with more or less zigzag white lineolation composing the pattern (fig. 13). The apex may be either roseate or pale, in perfectly preserved shells.

Var. *hoffmanni* Martens. Pl. 6, figs. 5, 6.

More slender, the upper and lower bands simple, the middle band only being maculated.

Alt. 19, diam. 9½, aperture 10½ mill.

*Central Costa Rica: Woods of San Lorenzo de Dota*, 1300 metres above the sea (Pittier). *S. W. Costa Rica: Heredia*, on trees (Carl Hoffmann, 1856).

D GABBI (Angas). Pl. 6, figs. 7, 8, 9, 10, 11.

Shell imperforate or subperforate, obliquely ovate, obese, thin but rather solid; white or light greenish-yellow, unicolored, or pale fleshy with scattered white dots and several spiral bands composed of irregular brown spots. Surface very glossy, smooth, with slight growth-lines but no spiral sculpture. Spire short, conic, the apex with typical *Drymæus* sculpture; whorls 4½–4⅔, slightly convex, the last large, oblique, flattened above on its latter portion, inflated at the periphery.

Aperture ovate, oblique, whitish within; *peristome thickened within*, a little expanded, *rose colored;* columellar margin narrowly reflexed above; columella narrow, concave; parietal wall deep rose-colored.

Alt. 22, diam. 14, length of aperture 12 mill.

Alt. 15, diam. 11½, length of aperture 8½ mill.

*Central Costa Rica*, upon the flank of Pico Blanco, alt. 3000–6000 ft., on the ground (Gabb); *N.-E. Costa Rica at La Paz*, on the road to the Rio Sarapiqui (Biolley).

*Bulimus gabbi* Angas, P. Z. S., 1879, p. 477, pl. 40, f. 3, 3a. Not *Bulimulus gabbi* Crosse & Fischer, 1872, see p. 147.—*Otostomus angasi* v. Martens, Biol. Centr. Amer., Moll., p. 207 (August, 1893).—*Bulimulus irazuensis* Binney, Ann. New York Acad. i, p. 262, pl. 11, fig. 1 (radula, jaw) (1879).—*Bulimulus gabbianus* Binney, Ann. New York Acad. iii, p. 124, pl. 12, f. L (jaw, teeth).

A very distinct and peculiar species, slightly resembling *D. castus* in the pink peristome, but much more closely allied to *D. tripictus* Alb., in form, absence of spiral sculpture, and in the color pattern. The peculiar oblique compression of the last whorl, most conspicuous as seen from behind, is a characteristic feature.

Von Martens changes the name to *angasi* on account of the prior *Bulimulus gabbi* of Crosse & Fischer; but the latter was described as a *Bulimulus*, not as a *Bulimus;* and as the present species is not a *Bulimulus*, and was not described as such, I fail to see that there is any conflict of names.

Binney has figured the radula under the names *B. irazuensis* and *B. gabbianus*. It has typical *Drymæus* dentition.

### Group of D. totonacus.

D. semimaculatus Pilsbry. Pl. 5, figs. 8, 9.

See vol. xi, p. 297. Described from Colombia, but specimens collected in Nicaragua by Gabb agree exactly with the types. The locality, "San Nicolas, Central Nicaragua," given on the authority of Tate (Amer. Journ. Conch., 1870, p. 156), should be deleted, Tate's specimens, some of which are before me, proving to be typical *D. dominicus*.

D. totonacus (Strebel). Pl. 5, figs. 11, 12, 13.

Shell thin though pretty solid, somewhat glossy, and rather translucent; bluish- or milk-white, sometimes with occasional transparent growth striæ, but always with widely-separated, small, triangular or rounded chestnut-brown spots, which are regularly placed in the line of growth-striæ, but more obviously along the spiral direction, forming five narrow bands represented by these spots, more distinct on the upper whorls where the spots are more closely placed. Sculpture of inconspicuous, fine longitudinal wrinkles with some coarser ones intermingled, decussated by fine and close, sharply-engraved, short-waved spiral lines, which are often interrupted and in places disappear on the last whorl. Whorls $5\frac{3}{4}$–$6\frac{3}{8}$, rather convex, the last somewhat ventricose (in young shells weakly keeled). Peristome generally expanded, the columellar margin narrowly reflexed above.

Alt. 34.6, diam. 13.4, length of aperture, 11.7 mill.

Alt. 28, diam. 11.2, length of aperture 8.6 mill.

*E. Mexico: Rancho de Quilate*, near Misantla (Doña Estefania, Höge); *Agua Caliente*, also near Misantla (Doña Estefania).

*Bulimulus totonacus* Strebel, Beitr. Mex. Land- und Süssw.-Conch. v, p. 84, pl. 5, fig. 13, 13a (shell); pl. 13, fig. 11, A. H. (radula); pl. 14, fig. 9 A–F, and 10 E (anatomy).—*Otostomus* (*Mormus*) *totonacus* Mart., Conch. Mittheil. ii, p. 193; Biologia, p. 221.

"This fine species is distinguished by its thin pure white shell, with not very numerous round brown spots; these are arranged on the last whorl in four spiral rows, on the preceding whorl in three, in the one before that in two rows, those of the second row being often a little larger than the others. The spots are placed rather distant one from the other, and they can also be regarded as being arranged in vertical rows, forming interrupted stripes from the suture towards the umbilicus, but this arrangement is not so regular as the spiral one. The spiral striæ of the shell are exceedingly fine. The aperture is pure white, the peristome very slightly reflected.

"The average length of the shell is 28–30 mill.; but one figured by Strebel (fig. 12) attains even 34½ mill., and one reported by Herr Höge, from Mexico, the locality of which is not especially stated, is only 24 mill. long. The breadth of the shell is equal to the length of the aperture and to about half the length of the whole shell." (*Martens.*)

The only species closely allied to this is *D. dormani*, but in that the spire is more conic. The name *totonacus* is derived from the name of the tribe of the Totonacs, that dwell in the district of Misantla.

D. DOMINICUS Reeve. (See p. 3.)

*Callejon de la Zamora, near Vera Cruz* (Strebel); *Mirador and Tabasco* (Berendt); *Chiapas* (Ghiesbreght); *Labna, Yucatan* (Heilprin Exped.); *San Nicolas, central Nicaragua* (Tate).

D. ALBOSTRIATUS (Strebel). Pl. 12, figs. 25, 26.

In most respects so similar to *D. dominicus* that only its differential characters need be stated. The shell is only slightly shining, light horn-color, and has separated, rather wide, whitish growth-streaks shading out on both sides. Apex brownish horn-color; between the 2d and 4th whorls three narrow dark brown bands appear, mostly interrupted and crossed by brown longitudinal streaks, forming an irregular marking quite similar to that of *B. heterogeneus.* The sculpture does not differ, and of the structure and form of the whorls it is only to be said that the basal half of the last whorl is sometimes darker colored. There is on the inner margin of the peristome a rather strongly thickened whitish streak, showing the whit-

ish streaks of the surface to be growth-periods. Columellar reflection, columella and umbilical chink as in *dominicus*.

Alt. 14.2, diam. 8.4, length of aperture 5.3 mill.; whorls $5\frac{1}{2}$.

Alt. 13.6, diam. 8.3, length of aperture 4.8 mill.;

*Tehuantepec*

*Bulimulus albostriatus* STREBEL, Beitr. Mex. Land- und Süssw.-Conch. v, p. 94, pl. 6, f. 3 (1882).

Based on four similar specimens received from an English dealer as an unknown species, among material from Tehauntepec, which in all probability was collected by Dr. Sumichrast. Very likely a form of *dominicus*.

D. CHAMPIONI (von Martens). Pl. 5, fig. 10.

Shell perforate, ovate-conic, thin, closely and finely spirally striated, shining, diaphanous whitish. Spire conic, the apex rather obtuse; whorls $6\frac{1}{2}$, slightly convex, regularly increasing, with the suture white, the last whorl ventricose; painted with a subsutural brown band becoming obsolescent in front, and some sparse brown spots. Aperture rhombic-oval, a little oblique; peristome thin, a trifle expanded, the columellar margin triangularly dilated, vertical, whitish.

Alt. 27, diam. $14\frac{1}{2}$, length of aperture 13, width 9 mill. (*Mart.*).

*W. Guatemala: Hacienda de Las Nubes, Cerro Zunil*, Pacific slope, in the vicinity of the coffee plantations, elevation about 5000 ft. (Champion.)

*Otostomus championi* MARTENS, Biol. Centr. Amer., p. 222, pl. 14, f. 5 (Sept., 1893).

Described from a single specimen.

D. EMEUS (Say). Pl. 4, figs. 52–61.

With crowded, minute, transverse striæ. Inhabits Mexico. Shell conic or elongate ovate, slightly angulated on the middle of the volutions, and covered with minute, undulated, impressed, capillary lines; whitish, with maculated bands; suture not deeply impressed; aperture shorter than the spire; labrum exteriorly simple, interiorly with a thickened submargin; columella short, recurved; umbilicus small, but distinct; spire with the angulation concealed by the suture; body whorl with the angulation almost obsolete. Length thirteen-twentieths of an inch; greatest breadth (parallel to the suture) three-tenths. (*Say.*)

*E. Mexico: Papantla and Misantla,* in woods (Deppe and Schiede); *Quilate, Arroyo del Obispo, Camino de Arroyo Hondo, and Rancho de Guerrero,* all near Misantla (Berendt and Strebel); *Nautla, Molino de Pedreguera, Coatepec, Dos Arroyos, Pacho, and Cuauatitlan,* all near Jalapa (Berendt and Strebel); *Jalapa, Playa Vicente, Cordova, and Atoyac* (Höge); *on the road from Vera Cruz to Mexico* (Say); *San Rafael, Jicaltepec* (Townsend.) *S. E. Mexico: Teapa in Tabasco* (H. H. Smith).

*Bulimus emeus* SAY, New Harmony Disseminator, Jan. 1, 1829, p. 26 (ed. Binney, p. 40).—PFR., Monogr. Helic. Vivent. ii, p. 221. —*Otostomus emeus* (Say) MARTENS, Biologia Centr. Amer., Moll., p. 222, pl. 14, f. 6, 6a, 8, 8a.—*Bulimus mexicanus*, var. *β. gracilior* PFR., Monogr. Helic. Vivent. ii, p. 102.—*Bulimus mexicanus* (Lamarck), REEVE, Conch. Icon. v, *Bulimus*, pl. 40, fig. 244.—*Bulimus* (*Liostracus*) *mexicanus*, var. *β. gracilior* MARTENS in Malak. Blätt. xii, p. 23 (1865).—*Bulimus ziegleri*, var. *β*, PFR., Monogr. Helic. Vivent. ii, p. 175.—*Bulimus ziegleri* REEVE, Conch. Icon. v, *Bulimus*, pl. 58, fig. 389.—*Bulimulus* (*Thaumastus*) *tryoni* FISCH. & CROSSE, Miss. Scient. Mex., Mollusca, i, p. 565 (part.)—*Bulimulus* (*Liostracus*) *alternans*, var. d, FISCH. & CROSSE, loc. cit., p. 501.—*Bulimus baezensis* (Hidalgo), PFR., Monogr. Helic. Vivent. viii, p. 47 (part.).—*Bulimulus palpaloensis* STREBEL, Beitr. Mex. Land- und Süssw.-Conch. v, pp. 85–87, pl. 5, figs. 12 *a–c*; pl. 13, fig. 14 (radula); pl. 15, figs. 1 A–L (anatomy); pl. 16, figs. 4, 7, 8, 11 (jaw). —*Otostomus* (*Drymæus*) *palpaloensis* MARTENS, Conch. Mittheil. ii, p. 190.—*Bulimulus sulphureus* Pfr., PILSBRY, Nautilus x, p. 59 (1896).

The following arrangement of color and local varieties is given by Dr. von Martens:

b. *hypozonus:* small, a little more ventricose, peristome unexpanded, usually yellow; bands only 1 or 2, basal, continuous. (*Bulimulus palpaloensis*, var. Strebel, loc. cit. p. 85, pl. 5, figs. 12d, 16).

*E. Mexico: Jalapa and Cordova* (Höge, M. Trujillo).

c. *albivaricosus:* much smaller; nearly unicolored, with few white streaks, bands visible only on the upper whorls (figs. 56, 57).

*E. Mexico: Playa Vicente*, dense forest, oaks prevailing (Höge).

d. *membranaceus:* unicolored, diaphanous whitish. (*Otostomus* (*Mormus*) *membranaceus* von Mart., Binnenmoll. Venez., p. 30 (specimen from Mirador).—*Bulimulus palpaloensis*, var., Strebel, Beitr. Mex. Land- und Süssw.-Conch. v, p. 85, pl. 5, fig. 12*e*.)

*E. Mexico: Mirador* (Sartorius); at one or more of the above-named localities, probably *Misantla* (Strebel).

This is identified by von. Martens with *B. membranaceus* Phil., with some doubt. I consider that species as more likely to be an Andean form. See vol. xi, p. 237.

*B. emeus var. membranaceus* is recorded by J. G. Cooper (Proc. Cal. Acad. 2d ser., p. 166) from the vicinity of Tepec, in western Mexico. This lends some color to the locality given in Monographia vi, p. 57: "Hab. in provinciis mexicanis pacificis;" but still I consider it improbable that a *Drymæus* of the east Mexican lowland should re-appear at Tepec.

Von Martens gives the following notes on *D. emeus:* The variations in color are fully described by Strebel; the ground-color is either white or pale yellow, and there are ordinarily five reddish-brown bands, which are either continuous or interrupted into rows of spots, or also very pale with darker spots. The lower bands are mostly continuous. The uppermost or the two upper bands are absent in several specimens; if also the third is wanting, we have the variety *hypozonus*, which, however, is ordinarily of a more ventricose form. Many young specimens show only two lower bands. The two and a half upper whorls are finely cancellated.

"Strebel states that this species is often found on a shrub called 'huichin,' which bears umbels of 40–50 yellow flowers (capitula?) and belongs to the natural order Compositæ; the botanical name of this plant he could not ascertain. Palpalo is the name of a river in the district of Misantla.

"This species has been greatly misunderstood and confounded with others, no doubt on account of its great variation in color and its peristome being so slightly expanded; in an artificial system it might quite as well be placed among the species with simple and straight as among those with expanded peristome. From the original description, together with the locality indicated, I have no doubt that Say's *Bulimus emeus* is identical with Strebel's *Bulimulus palpaloensis*" (Martens). For *Bulimus mexicanus* of Lamarck, see vol. xi, p. 291.

D. TRYONI (Fischer & Crosse). Pl. 3, fig. 53.

Shell acuminately ovate, thin, but slightly umbilicated, whorls 6 to 7 in number, longitudinally finely striated; columella reflected, lip thin, simple. Whitish encircled by three or four zones of blackish-brown (*Reeve*).

Alt. 28, diam. 14, length of aperture 13 mill. (from fig.)

*N. W. Mexico: Sinaloa* (Tryon). *Mexico*, without nearer indication of locality (Reeve).

*Bulimus mexicanus* (Lamarck), REEVE, Conch. Icon. v, *Bulimus*, pl. 40, fig. 244.—*Drymæus mexicanus* (Lamarck), TRYON, Am. Journ. Conch. iii, p. 168, pl. 9 (13), fig. 5 (copy from Reeve) (1867). Not *B. mexicanus* Lam., see vol. xi, p. 291.—*Bulimulus* (*Thaumastus*) *tryoni*, FISCH. & CROSSE, Miss. Scient. Mex., Mollusca, i, p. 565, and v. *pochutlensis*, pl. 24, f. 3, 3a.—*Otostomus tryoni* MARTENS, Biologia, p. 232.

A somewhat doubtful species, based upon Reeve's figure of "*B. mexicanus*." I do not know where the specimens are upon which Tryon based the locality "Cinaloa." It seems to be near *D. emeus* Say.

Var. POCHUTLENSIS Crosse & Fischer. Pl. 3, figs. 54, 55.

Encircled by brown, white and pale tawny bands; peristome whitish-brown.

Alt. 24, diam. 11½ mill. (C. & F.)

*W. Mexico: Pochutla, near Chilapa, in the State of Guerrero* (Sallé).

GROUP OF D. SULPHUREUS.

D. SULPHUREUS (Pfeiffer). Pl. 4, figs. 65, 66, 67, 68.

Shell perforate, ovate-conic, thin, somewhat translucent, pale sulphur colored or (probably by exposure to light) white. Surface glossy, with slight growth striæ and fine, regular engraved spiral lines. Spire lengthened-conic, apex rather obtuse. Whorls 5¾–6 (6½ according to Pfr.), but slightly convex, the last convex. Aperture decidedly oblique, ovate; peristome slightly and narrowly expanded at the edge, the columellar margin shortly reflexed above, impressed at its insertion; columella straight above.

Alt. 29½, diam. 15, length of aperture 14½ mill.

Alt. 28, diam. 14, length of aperture 13½ mill.

*Central Mexico: near the city of Mexico* (Hahn). *E. Mexico: Consolapa and Soncoantla*, both near Jalapa (Strebel); *Mirador* (Strebel); *Atoyac and Orizaba* (Höge); *Cordova* (Sallé); *S. E. Mexico: Teapa in Tabasco* (H. H. Smith). *N. Guatemala: Cubilguitz*, north of Coban, in the dense forests of Vera Paz, drainage into the Rio de la Pasion (Champion); *Chiacam*, near Lanquin, on the Ca-

habon River (Champion); *Coban* (Sarg); *San Joaquin*, below San Cristobal, in the valley of Rio Chisoy (Champion); *Chacoj and Senahu*, *Polochic Valley* (Champion); *Panzos* in the same valley (Conradt and Godman). *Nicaragua: La Libertad* (Belt).

*Bulimus sulphureus* Pfr., P. Z. S., 1856, p. 318, pl. 35, fig. 11; Monogr. Helic. Vivent. iv, p. 412.—*Bulimulus* (*Drymæus*) *sulfureus* von Mart., in Albers' Die Helic., edit. 2, p. 212.—*Bulimulus* (*Drymæus*) *sulphureus* Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 495, pl. 23, figs. 3, 3*a*.—*Bulimulus sulphureus* Strebel, Beitr. Mex. Land- und Süsswasser-Conch., v, p. 87, pl. 5, figs. 11 a–d; pl. 13, figs. 15, 15*b*, 16 (radula); pl. 15, figs. 2 A–C (anatomy).—*Otostomus* (*Drymæus*) *sulfureus* von Martens, Conch. Mittheil., ii, p. 192; Biol. Centr. Amer., p. 225, pl. 14, f. 14–18.—*Bulimus moricandi* (Pfr.), Tristr., P. Z. S., 1861, p. 230.

Dr. von Martens writes of this species thus: "Animal greenish (*Berendt*). Animal of var. *citronellus* white; tentacles very long; arboreal (*Gabb*). H. Pittier found the same variety under the bark of a dead tree.

"This species has been confounded sometimes with the white *O.* (*Helix*) *liliaceus* of Férussac (*antea*, p. 10), from Porto Rico. According to the specimens collected by Herr Gundlach at Quebradillas and elsewhere in this island, *O. liliaceus* differs from *O. sulphureus* not only in its pure white, somewhat cretaceous color, but also in the more conical form of its shell, the last whorl being less attenuated beneath, more bag-like (*saccatus*)." As the difference is more easily explained by a drawing than by description, the figures of the Porto Rican shell should be referred to (pl. 13, figs. 90, 91, 92).

"Although neither the figure in Deshayes' continuation of Férussac's Hist. Nat. Moll. Terr., pl. 142 B, fig. 11, nor that given by Fischer & Crosse (pl. 23, fig. 8), exhibits this difference very clearly, I prefer to restrict the name *liliaceus* to the Porto Rican shell. Férussac's, fig. 14, and Fischer & Crosse's, fig. 8*a*, well represent *O. flavidus* Menke, from Venezuela: see my essay on the Land and Fresh-water Mollusca of Venezuela (Die Binnenmollusken Venezuela's), p. 29 (1873). *O. virginalis* Pfr., from Venezuela, common near Caracas, also belongs to the same group; it is white, and nearly as slender as var. *b* of *sulphureus*, with proportionately smaller aperture, only two-fifths of the length of the shell. Pfeiffer (Novitates Conchologicæ, iii, p. 422), mentions a variety of it from Chiapas,

distinguished by the more rounded last whorl and a rounded aperture; I suspect this is a whitish specimen of *O. sulphureus*, var. *b*.

"The specimens of *O. virginalis* examined by Strebel, Beitr. Mex. Land- und Süsswasser-Conch. v, pp. 88, 89, were from Caracas."

Dr. von Martens notes the following variations:

*b*. Whitish. (Fisch. & Crosse, l. c. p. 496. pl. 23, f. 8). *Jalapa* (Höge); Teapa, in Tabasco (H. H. Smith); Northern Guatemala at San Luis de Peten (Morelet), and Coban (Bocourt, Salvin).

*c*. Var. *gracilior*. Pl. 4, fig. 65. Length 28–29, diam. 11–12, aperture 11–13 mill. (F. & C., l. c. p. 496, pl. 23, fig. 8*a*; Strebel, l. c., p. 88, pl. 6, fig. 5.)

*N. Guatemala: Senahu* (Champion). *W. Guatemala; Retalhulen* (Stoll). *S. W. Guatemala: San Agustin* (Bocourt); *Zapote*, on the slope of the Volcan de Fuego (Champion). *Nicaragua: La Libertad* (Belt).

"Our var. *c*, *gracilior*, is very near *O. flavidus* Menke [see vol. xi, p. 310, pl. 26, figs. 71–73; Férussac, pl. 142 B. fig. 14; Reeve, Conch. Icon. v, *Bulimus*, pl. 45, fig. 287 (liliaceus)]; but I have not yet seen a specimen from Mexico or Central America with the delicate rosy hue on the lower half of the last whorl, which is so characteristic of this species."

*d*. Var. *citronellus:* Angas (pl. 4, fig. 67), subconic, bright yellow, the suture white. Length 27, diam. 13, aperture 12 mill. (*Bulimus citronellus* Angas, P. Z. S., 1879, p. 479, pl. 40, fig. 5).

*N.-E. Costa Rica: Puerto Viejo* on the Rio Sarapiqui (Biolley). *Central Costa Rica: San José, and La Uruca near San José* (Biolley); *Alajuela* at an elevation of 900 to 1000 metres above the Sea (Orosco); *Suralres*, alt. 600 metres, near San Mateo (Biolley). *S. W. Costa Rica: Boruca*, alt. 450 metres (Pittier); *Alto de Mano Tigre*, 690 metres (Pittier). *S. E. Costa Rica: between Urea and Liporia*, on the low hills (Gabb).

*e*. Var. *obesus* Mart. (pl. 4, fig. 68). Subconic, shorter, uniform whitish. Long. 26, diam. 14, apert. 13 mill.

*E. Mexico: Huatusco*, in the State of Vera Cruz (Hille, in Dunker's collection).

D. MORICANDI (Pfeiffer). Pl. 4, figs. 62, 63, 64.

Shell perforate, ovate-conic, thin, engraved with subcontinuous spiral lines; subdiaphanous, citron-colored. Spire conic, rather

acute; suture submargined with a paler tint. Whorls 6, slightly convex, the last as long as the spire; columella straightened; aperture suboblong, truncate-oval, colored within like the outside; peristome simple, narrowly expanded, the columellar margin shortly reflexed above.

Alt. 24, diam. 12, length of aperture 13 mill. (*Pfr.*).

*N. Guatemala: Coban* (Delattre); *Vera Paz* (Morelet).

*Bulimus moricandi* Pfr., P. Z. S., 1846, p. 113; Monogr. Helic. Vivent., ii, p. 109.—Reeve, Conch. Icon. v, *Bulimus*, pl. 45, fig. 283.—*Bulimus* (*Leiostracus*) *moricandi* Pfr., in Malak. Blätt. ii, p. 153 (1855).—*Bulimulus* (*Liostracus*) *moricandi* Mart., in Albers' Die Helic., ed. 2, p. 213.—*Bulimulus* (*Drymæus*) *moricandi* Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 497, pl. 24, figs. 9, 9*a*. —*Otostomus moricandi* von Martens, Biol. Centr. Amer. p. 227.

Var. *hyalino-albidus*. Clear whitish. *Bulimus moricandi* var., Pfr., Monogr. Helic. Vivent. iv, p. 398; *Bulimulus* (*Drymæus*) *moricandi* var. *β*, *hyalino-albida* Fisch. & Crosse, loc. cit., p. 498).

*S. Mexico: Chiapas* (*Ghiesbreght*); *Yucatan* (F. D. Godman); *E. Guatemala: Yzabal* (Stoll).

Evidently very close to *D. sulphureus*, from which its somewhat more ventricose form, larger aperture, and stouter, perhaps convexly-conic spire, may perhaps distinguish it. Specimens before me labelled "B. moricandi, Guatemala, Sarg," prove to be merely *sulphureus*.

### Group of D. multilineatus.

D. multilineatus (Say). See page 27.

D. moritinctus (von Martens). Pl. 6, figs. 26, 27, 28, 29.

Shell rimate, ovate-oblong, rather thin, irregularly striatulate, shining; isabelline-whitish, with very few oblique streaks, a single rather wide peripheral band of blackish, and sparsely scattered dots of the same color. Spire conic, the apex rather obtuse, blackish or brown. Whorls 6, a little convex, the last slightly attenuated basally, and sometimes rose-tinted there.

Aperture half the length of the shell, a little oblique, acuminate-oblong, colored within like the outside; peristome simple, not expanded, the columellar margin thin, lightly arcuate, shortly reflexed and appressed at the umbilical chink.

Alt. 26–29, diam. 13, length of aperture 14–15 mill. (*Mart.*)

*W. Mexico: Chilpancingo, State of Guerrero,* at an altitude of 4600 ft. (H. H. Smith.)

*Otostomus moritinctus* MARTENS, Biol. Centr. Amer., p. 228, pl. 14, f. 9, 10 (Sept., 1893.)

A very distinct species, allied to *D. livescens*, but thinner, larger, with more ventricose whorls and larger aperture. One of the specimens before me shows scarcely any of the scattered dots mentioned above, and in another the peripheral band is only faintly indicated. The apex shows the fine grating characteristic of *Drymæus*. Von Martens writes:

"Varies somewhat in the more or less pure whitish, yellowish or slightly reddish hue of the general coloration, in the more or less broad and dark peripheral band, in the presence, disposition, and number of the black points, which are either arrow-like or rounded, and in the presence or absence of a large brown streak near the aperture; the base of the shell near the umbilical cleft is in some examples bright rose-colored. The uppermost whorl is curiously punctured."

D. LIVESCENS (Pfeiffer). Pl. 4, figs. 76–81.

Shell scarcely perforate, ovate-turreted, smooth, livid-whitish marked with a few brownish streaks. Spire long, acute. Whorls 7, nearly flat, the last shorter than the spire. Aperture narrow, oblong, brownish inside; peristome simple, the columellar margin slightly revolute, covering the small perforation.

Alt. 23, diam. 9, length of aperture 10, width 5 mill. (*Pfr.*)

*Central Mexico: Tehuacan* (Hegewisch, Uhde); *Tecomavaca, in the State of Puebla*, S. E. of Tehuacan, *Cactus* and *Mimosa* region (Höge). *W. Mexico: Chilpancingo, in the State of Guerrero* (H. H. Smith).

*Bulimus livescens* PFR., Symb. Hist. Helic. ii, p. 48 (1842); Monogr. Helic. Vivent. ii, p. 175.—REEVE, Conch. Icon. v, *Bulimus*, pl. 47, fig. 304.—PHILIPPI, Abbild. neuer Conch. iii, p. 96, pl. 9, fig. 3.—*Bulimus* (*Mesembrinus*) *livescens* ALBERS, Die Helic. ed. 1, p. 157—PFR. in Malak. Blätt. ii, p. 158 (1855).—*Orthalicus* (*Mesembrinus*) *livescens* H. & A. ADAMS, Gen. Rec. Moll. ii, p. 157.—*Bulimulus* (*Mesembrinus*) *livescens* VON MART. in Albers' Die Helic., ed. 2, p. 214; Malak. Blätt. xii, p. 27 (1865).—FISCH. & CROSSE, Miss. Scient. Mex., Mollusca i, p. 543.—*Bulimulus livescens* STREBEL,

Beitr. Mex. Land- und Süssw.-Conch. v, p. 91, pl. 6, fig. 4.—*Otostomus livescens* VON MARTENS, Biol. Centr. Amer., p. 228, pl. 15, f. 7, 8 (var.).

The original diagnosis describes the shell as streaked, no bands being mentioned; and the locality was merely "Mexico." It seems allied to *moritinctus* and especially to *discrepans*. Von Martens enumerates the following color-forms:

*a*. Brown bands and streaks distinct.

*b*. Bands and interstitial streaks paler.

*c*. Three bands, no streaks (fig. 79).

*d*. Upper band narrow, lower a little wider, a series of spots between (fig. 78).

*e*. Two basal bands (figs. 80, 81).

*f*. Subunicolored whitish, with a few streaks (typical form).

D. DISCREPANS (Sowerby). Pl. 12, figs. 18, 19.

Shell subperforate, oblong-ovate, thin; whitish, with few or numerous *narrow, brown, obliquely-longitudinal streaks, interrupted at the periphery by a narrow white spiral band, below which there is a faint or distinct, wide corneous band upon which the streaks reappear, succeeded by a wide whitish band; a very narrow umbilical area being defined by a narrow brown band.* Surface shining, smooth, under a strong lens showing slight growth-striæ and faint, fine, dense spiral lines. Spire conic, the apex obtuse, with typical *Drymæus* sculpture. Whorls nearly 6, moderately convex.

Aperture less than half the shell's length, ovate, striped inside, oblique; peristome thin and not expanded; columellar margin narrowly reflexed at the perforation, which it nearly closes.

Alt. 18, diam. 9, length of aperture 8 mill.

Alt. 17, diam. 8, length of aperture $7\frac{1}{2}$ mill.

*Central Guatemala: Salama* (Morelet); *San Geronimo* near Salama (Champion). *E. Guatemala: Zacapa*, on *Cereus* sp. (Stoll). *Salvador: Conchagua*, under the bark of trees (Cuming; type locality). *Central Nicaragua: Granada, Masapa, San Nicolas*, in the Savana region (Tate). *N. W. Costa Rica: Guanacasta, in the Bay of Salinas*, in the woods (Pittier).

*Bulinus discrepans* SOWERBY, P. Z. S., 1833, p. 72; Conch. Illustr., *Bulinus*, fig. 52.—*Bulimus* (*Bulimulus*) *discrepans* BECK, Index Moll., p. 65.—*Bulimus discrepans* DESHAYES, in Lamarck's

Hist. Nat. des Anim. sans Vert., ed. 2, viii, p. 279.—Pfr., Monogr. Helic. Vivent. ii, p. 176.—Reeve, Conch. Icon. v, *Bulimus*, pl. 23, fig. 145.—Tate, Amer. Journ. Conch. v, pp. 152, 156 (1870).—*Bulimus* (*Mesembrinus*) *discrepans* Albers, Die Helic. ed. i, p. 158—Pfr., in Malak. Blätt. ii, p. 158 (1855).—*Orthalicus* (*Mesembrinus*) *discrepans* H. & A. Adams, Gen. Rec. Moll. ii, p. 157.—*Bulimulus* (*Liostracus*) *discrepans* Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 503.—*Otostomus discrepans* von Martens, Biol. Centr. Amer., p. 230.

Allied to *D. livescens* and some forms of *D. multilineatus*, but thinner than the latter, with fewer whorls and somewhat different coloration. Some specimens show a narrow spiral band revolving a little above the middle on the ante-penultimate and next earlier whorls. Specimens from Guanacasta examined by Dr. von Martens are smaller, measuring: Alt. 16, breadth 8, and aperture 9 mill. Sowerby's type from Conchagua measured: Alt. 0.7, diam. 0.33 inch.

D. semipellucidus (Tristram). Pl. 4, figs. 71, 72, 73.

Shell imperforate, oblong-conic, fragile, shining, semipellucid, white, marked with sparse opaque streaks. Spire conic, acute; suture deep. Whorls 6, convex, the last a little longer than the spire, inflated, rounded at base; columella vertical, straightened. Aperture slightly oblique, angulate-oval; peristome thin, the right margin very little expanded, columellar margin shortly reflexed.

Alt. 18, diam. 8 mill. (*Tristr.*)

*Guatemala* (Salvin). *N. W. Costa Rica: Guanacasta, in the Bay of Salinas* (Pittier). *N. E. Costa Rica: Puerto Viejo, on the Rio Sarapiqui* (Biolley). *Central Costa Rica: Alajuela* (Orosco).

*Bulimus semipellucidus* Tristram, P. Z. S., 1861, p. 230, pl. 26, fig. 8.—Pfr. Monogr. Helic. Vivent. vi, p. 22.—*Bulimulus* (*Liostracus*) *semipellucidus* Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 507.—*Otostomus semipellucidus* Martens, Biologia, p. 236, pl. 15, f. 10.

"I am rather inclined to think that this is an albino variety of *O. discrepans*. The specimen from Guanacasta, from which our figure is taken, has a few brownish oblique stripes on the whorl before the last, whereas in all respects it agrees with the Rev. H. B. Tristram's description and figure; but as the whorls are a little more convex than in *O. discrepans*, and the umbilical cleft completely closed, I

dare not assert it positively. Tristram's figure is somewhat magnified, as is proved by his statement in the text, that the length of the shell is 18 mill. He gives the breadth as 8 mill.; but this is too narrow, as by reducing the measurements of his figure we find $9\frac{1}{2}$ mill. as the breadth of the last whorl. Probably he has, judging from the example of Dr. Pfeiffer, measured the breadth just above the upper edge of the aperture, which is in reality the breadth of the penultimate whorl. This must be kept in mind when comparing my measurements with those given by Dr. Pfeiffer.

"The Costa Rica specimens have stripes only on the upper whorl and also here less numerous than in the type." (*Martens.*)

D. UHDEANUS (v. Martens). Pl. 15, figs. 47–53.

Shell rimate, oblong-conic, rather thin, perpendicularly rather coarsely striate, showing very fine spiral lines under a lens, opaque, fleshy-straw-colored, usually ornamented with three white bands. Spire long-conic, rather acute, the apex corneous-yellow. Whorls 6, convex, the last tapering at base. Aperture oval-oblong, colored within like the outside and slightly roseate, columella a little arcuate, rose colored; peristome simple, unexpanded, the columellar margin narrowly reflexed and overhanging.

Alt. 22, diam. 10, length of aperture 10 mill. (Mart.).

*Mexico*, without nearer indication of locality (*Uhde*). *E. Mexico: Aculcingo, State of Vera Cruz, south of Orizaba* (Boucard). *W. Mexico: Sayula, State of Jalisco* (Höge).

*Bulimulus* (*Mesembrinus*) *uhdeanus* VON MART., in Monatsber. Akad. Wiss. Berl., 1863, p. 541; Malak. Blätt. xii, p. 25, pl. 1, figs. 4, 5 (1865).—PFR., Monogr. Helic. Vivent. vi, p. 114.—*Bulimulus* (*Scutalus*) *uhdeanus* FISCH. & CROSSE, Miss. Scient. Mex., Mollusca, i, p. 530, pl. 21, figs. 4, 4*a*.—*Bulimulus uhdeanus* STREBEL, Beitr. Mex. Land- und Süssw.-Conch. v, p. 90, pl. 11, figs. 11*a*, *b*.—*Otostomus uhdeanus* MARTENS, Biologia, p. 233, pl. 15, f. 1–6 (with vars. *cuernavacensis*, *tepecensis* and *borealis* (Sept., 1893.)

"The first one and a half whorls are unicolorous, yellow, and finely reticulated. The typical form may be described as white with fawn-colored bands, or fawn-colored with white bands; the latter definition is perhaps the best, as the fawn occupies a greater part of the surface, and is the only color present in subvar. *c*, and I have used it in my earlier descriptions. But if we examine the var. *cuernavacen-*

*sis*, and the majority of the other species of this genus, we shall, perhaps, prefer to regard the coloration as white with fawn bands, but then we must admit that the uppermost band reaches the suture and the lowest one the umbilicus, and that the unicolorous subvariety *c* is produced by all the bands uniting together. The variation in the number of bands is caused by the uppermost disappearing, and by the fourth and fifth uniting into one.

"This species, as regards the shell, bears some resemblance to *Bulimulus exilis* Gmel. (*guadelupensis* Brug.), the type of the genus *Bulimulus;* but having examined the radula of *O. uhdeanus*, I have found that it agrees better with that of *Otostomus*, the median tooth being also remarkably smaller than the neighboring ones" (*v. Martens*).

The following varieties are distinguished by von Martens:

*A*. Typical. Length 22, diam. and aperture 10 mill.

*a*. Whitish, with 3–5 pale fulvous equal bands (figs. 49, 50).

*b*. Whitish, with 5 pale fulvous bands spotted with brown (fig. 48.)

*c*. Unicolored pale fulvous (fig. 47).

*B*. Var. *cuernavacensis* C. & F. (pl. 15, figs. 42, 51). Larger, the bands more distinct, rather broad; length 29, diam. 15, aperture 13 mill.

*Central Mexico: Cuernavaca* (Boucard). *E. Mexico, Orizaba and Maltrata, a little west of Orizaba* (Höge).

*Bulimulus* (*Scutalus*) *cuernavacensis* CROSSE & FISCH., in Journ. de Conch. xxii, p. 283 (1874); FISCH. & CROSSE, Miss. Scient. Mex., Mollusca i, p. 532, pl. 23, fig. 11, 11*a* (young?).—*Bulimus cuernavacensis* PFR., Monogr. Helic. Vivent. viii, p. 152.—*Bulimulus cuernavacensis* STREBEL, Beitr. Mex. Land- und Süssw.-Conch. v, p. 65, pl. 12, fig. 17.

*C*. Var. *tepecensis* Martens (pl. 15, fig. 52). Smaller, upper whorls banded, median ones maculated, the last pale, with one wide weak band on the base. Alt. 18, diam. 9, aperture 8½ mill.

*West Mexico: Tepec, State of Jalisco* (Höge).

*D*. Var. *borealis* Martens (pl. 15, fig. 53). Smallest, grayish-white, above with 1–3 series of spots, beneath with one wide pale band. Alt. 15, diam. 8, aperture 7 mill.

*N.-W. Mexico: Ventanas, State of Durango*, at 2000 ft. elevation. (Forrer.)

D. HETEROGENEUS (Pfeiffer). Pl. 12, figs. 22, 23.

Shell subperforate, ovate-turreted, thin, striatulate, decussated with microscopic spiral lines, slightly shining, whitish-corneous. Spire elevated conic, the apex rather acute, suture impressed, simple. Whorls $6\frac{1}{2}$, a little convex, the apical unicolored, following with chestnut lines and dots, last two painted with pale corneous streaks, on the penultimate whorl irregularly spotted; last whorl about $\frac{2}{5}$ the total length, rounded at base. Columella receding. Aperture oblique, angulate lunar; peristome simple, the right margin a trifle expanded, columellar margin dilated above, overhanging, subappressed.

Alt. 17, diam. $7\frac{1}{2}$, length of aperture 8 mill. (*Pfr.*)

*W. Mexico: Tepec, State of Jalisco* (Höge). *E. Mexico: Mirador, Pala Gacho, on the road from Vera Cruz to Jalapa, and Rinconada near the same place* (Strebel); *Vera Cruz* (Berendt, type locality).

*Bulimus heterogeneus* PFR. in Malak. Blätt. viii, p. 118 (1866); Monogr. Helic. Vivent. vi, p. 118.—*Bulimulus* (*Liostracus*) *heterogeneus* FISCH. & CROSSE, Miss. Scient. Mex., Mollusca i, p. 506.—*Bulimulus heterogeneus* STREBEL, Beitr. Mex. Land- und Süssw.-Conch. iv, pl. 6, fig. 18 *a*, *b*; v, p. 92.—*Otostomus heterogeneus* MARTENS, Biologia, p. 235.

"The species approaches *O. livescens*, as Strebel has already stated, and *O. discrepans*. From *O. livescens* it differs in the somewhat more convex whorls, the less tapering spire, the more yellowish hue of the white color, the subangular last whorl, and the very slight turning out of the apertural margin; the last mentioned character proves it to be adult, although the shell has one whorl less than that of *O. livescens*. The stripes are pale brown, disposed at unequal intervals, and very variable; they are seen chiefly on the whorl before the last, sometimes also on the last, while on the other whorls spiral rows of spots, or even bands, also pale, however, predominate. On account of some of the whorls being differently painted to the others, Dr. Pfeiffer seems to have used the name "*heterogeneus*," which at first leads one to suppose that the species possesses much more peculiar and unusual characters" (*v. Martens*).

D. TROPICALIS (Morelet). Pl. 6, figs. 21, 22, 23.

Shell sinistral, perforate, long ovate-conic; moderately solid; white with two or three pink or pinkish-brown spiral bands, the tip of the

apex of the same color. Surface somewhat shining, smooth, showing fine, superficially engraved spiral lines under a strong lens. Spire high, straight-sided, the apex obtuse, with typical *Drymæus* sculpture. Whorls 6½–7, but slightly convex.

Aperture small, ovate, typically showing the bands inside; peristome acute, thin, unexpanded; columellar lip triangularly reflexed above; columella straight.

Alt. 28, diam. 12, length of aperture 12 mill.

Alt. 21½, diam. 10, length of aperture 9 mill.

*Yucatan: Campeche*, on the shore (Morelet); *Tabi*, *S. of Merida*, in the interior (F. D. Godman, Febr., 1888); *Ruins of Labna* (Heilprin Exped.).

*Bulimus tropicalis* MORELET, Test. Noviss. i, p. 9 (1849).—PFR., in Martini & Chemnitz, Syst. Conch.-Cab., ed. 2, *Bulimus*, p. 198, pl. 55, figs. 5, 6; Monogr. Helic. Vivent. iii, p. 424.—*Bulimus* (*Pyrgus*) *tropicalis* PFR., in Malak. Blätt. ii, p. 159 (1855).—*Bulimulus* (*Liostraeus*) *tropicalis* FISCH. & CROSSE, Miss. Scient. Mex., Mollusca, i, p. 504, pl. 20, figs. 7, 8.—*Bulimulus tropicalis* STREBEL, Beitr. Mex. Land- und Süssw.-Conch., v, p. 95.—PILSBRY, Proc. Acad. Nat. Sci. Phila., 1891, p. 315.—*Otostomus tropicalis* MARTENS, Biol. Centr. Amer., p. 233.

The specimens collected by Morelet (pl. 6, figs. 21, 22) have three brownish-red bands on the last whorl, and are 27 to 28 mill. long, with 7 whorls. Those taken at Labna by the expedition from the Academy (fig. 23) are smaller, 21–22 mill. long, with the bands pink, the upper two almost obsolete, and with a pink band just behind the columella, which is somewhat stained with the same tint. The young are a little keeled and the bands are more brown. This is the only sinistral species of *Drymæus* known.

### GROUP OF D. ALTERNANS.

D. ALTERNANS (Beck). Pl. 15, figs. 38, 39, 40.

Shell narrowly perforate, ovate-conic, thin but moderately solid; white or faintly buff-tinted with five spiral brown bands; the upper one narrow, bordering the white-edged suture, the fifth forming a rather large umbilical patch. Surface glossy, smooth, with slight growth wrinkles and close, fine, engraved spiral striæ, in some specimens subobsolete in places. Spire conic, the apex rather obtuse, having typical Drymæus sculpture. Whorls 5½, moderately convex.

Aperture ovate, banded inside, oblique; peristome thin, not expanded, the columellar margin triangularly reflexed above; columella straight or with a low convex fold above. Alt. 20, diam. 11, length of aperture 9–10 mill. .

*N. Guatemala: Panzos* (Conradt). *Central Guatemala: San Gerónimo*, near Salama (Champion); *vicinity of Guatemala City* (Stoll). *Central Costa Rica: San José* (Pittier); *La Uruca*, near San José, at an elevation of 100 metres above the sea, under dry leaves (Biolley); *Alajuela* (*Orosco*). *S. Panama: Isla del Rey* (*San Miguel*) in the Pearl Islands, and *Taboga Island*, both in the Bay of Panama (coll. Cuming).

*Bulinus vexillum* Broderip, P. Z. S., 1832, p. 105.—Sowerby, Conch. Illustr., *Bulinus*, fig. 26.—*Bulimus vexillum* Deshayes, in Lamarck, Hist. des Anim. sans Vert., ed. 2, viii, p. 272.—Reeve, Conch. Icon. v, *Bulimus*, pl. 23, fig. 152 (not of Wood, 1828).—*Bulimus* (*Bulimulus*) *alternans* Beck, Index Moll. p. 65 (1837).—*Bulimus alternans* Pfr., Monogr. Helic. Vivent. ii, p. 207.—*Bulimus* (*Leptomerus*) *alternans* Albers, Die Helic. ed. 1, p. 166.—Pfr., in Malak. Blätt. ii, p. 160 (1855).—*Orthalicus* (*Leptomerus*) *alternans* H. & A. Adams, Gen. Rec. Moll. ii, p. 156.—*Bulimulus* (*Liostracus*) *alternans* v. Mart., in Albers' Die Helic., ed. 2, p. 213.—Binney, Ann. Lyc. Nat. Hist. of N. Y., x, p. 305 (jaw and radula).—Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i. p. 500, pl. 23, fig. 5.—O. Stoll, Guatem. Reisen. p. 33.—*Liostracus alternans* W. G. Binney, Ann. N. Y. Acad. Sci. iii, p. 122 (jaw and radula).—*B. alternatus* Forbes, P. Z. S., 1850, p. 54 (not of Say).

More allied to the thin, banded species of Colombia, Trinidad, etc., than to any of the preceding Mexican species. The number of bands is constantly five, in the series before me, but they vary in width. Usually the fourth band is wider than those above, and the second band narrow; but in some shells the second band is wide, and the third reduced. Von Martens writes:

"Dr. O. Stoll has observed this species upon a shrub, *Baccharis salicifolia*, in company with *O. jonasi* but much less frequent. During the dry season it conceals itself beneath stones and amongst the roots of the above-mentioned shrub, more rarely on its branches, and closes the aperture with a thin transparent epiphragma; in this state it often becomes the prey of the rapacious *Glandina aurata*, which does not ascend the shrubs. He mentions also that full-grown spe-

cimens are comparatively rare. An unusually large specimen—long. 28, diam. 14, apert. 11 mill.—found at Panzos (*Conradt*), has been sent to me by Prof. Hausknect of Weimar; its bands are very dark, nearly black, the shell thus approaching *O. nigro-fasciatus* Pfr., from Colombia [vol. xi, p. 307, pl. 50, figs. 98, 99], but differs from it in the distinct spiral striation and the comparatively narrower bands."

Var. JUQUILENSIS Martens (fig. 40). Bands narrower. Length 19½, diam. 9–10 mill.

*S. Mexico: Juquila, in the State of Oaxaca* (Boucard); *Oaxaca* (Uhde). *N. Guatemala: Vera Paz* (Salvin).

*Bulimus virgulatus* TRISTRAM, P. Z. S., 1863, p. 412.—*Bulimus alternans* var. β, PFR., Monogr. Helic. Vivent. vi, p. 131.—*Bulimulus* (*Liostracus*) *alternans*, var. β, FISCH. & CROSSE, Miss. Scient. Mex., Mollusca i, p. 501, pl. 23, fig. 5*a*.—*Otostomus* (*Liostracus*) *alternans* VON MART. Conch. Mittheil. ii, p. 192.—*Bulimulus* (*Liostracus*) *mexicanus*, var., VON MART., in Malak. Blätt. xii, p. 24 (1865) (*ex parte*).

D. TRICINGULATUS (Anton).

Shell oval-conic, spire nearly steeple-shaped, acute; 7 rather flat whorls with deep suture, the last whorl two-fifths the whole length; translucent, shining, smooth; light yellow with three dark-brown bands on the last whorl, and two light brown ones on the others; perforate; aperture oval-oblong. Alt. 1 inch 1 line, diam. 6 lines. (*Anton.*) *Saboja Ins.* (Anton).

*Bulimus tricingulatus* ANT., Verzeich. der Conch. Sammlung H. E. Anton, p. 43, no. 1566 (1839).—PFR., Monogr. ii, p. 212.

More lengthened than *vexillum* (Brod.), the last whorl more obese, somewhat shorter, and, therefore, more conic-oblong. Besides the ground-color, the slim form and delicate peristome also distinguish it from *trifasciatus* Brug. (*Anton.*)

Has not been recognized by later authors. The locality is evidently Taboga island, in the Bay of Panama.

D. HONDURASANUS (Pfeiffer). Pl. 15, fig. 41.

Shell openly perforate, ovate-conic, smooth, shining; yellowish-white, ornamented with three bands and an umbilical area of rose-brown. Spire conic, acute, whorls 6, a trifle convex, the last a little shorter than the spire; columella straightened, vertical, the aperture

oval-oblong, colored within like the outside ; peristome unexpanded, simple, the columellar margin expanding in a triangular plate. Alt. 18½, diam. 10, length of aperture 9 mill. (*Pfr.*)

*Honduras* (Dyson).

*Bulimus hondurasanus* Pfr., P. Z. S., 1846, p. 29; Monogr. Helic. Vivent. ii, p. 209.—Reeve, Conch. Icon. v, *Bulimus*, pl. 59, fig. 400. —? *Bulimus honduratianus* Tristram, P. Z. S., 1861, p. 230.—*Bulimus* (*Leptomerus*) *hondurasanus* Pfr. in Malak Blätt. ii, p. 160 (1855).—*Orthalicus* (*Leptomerus*) *hondurasanus* H. & A. Adams, Gen. Rec. Moll. ii, p. 156.—*Bulimulus* (*Liostracus*) *hondurasanus* Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 503.—*Otostomus honduranus* von Martens, Biol. Centr. Amer. p. 232.

Known to me only by the description and Reeve's figure, and perhaps, as von Martens remarks, not separable from *D. alternans*. "A very delicate, transparent, rose-tinged shell." (*Rve.*)

D. translucens (Broderip). Pl. 24, figs. 28, 29.

Shell oblong-pyramidal, with a small umbilical chink, pale yellowish white, *translucent*, thin ; surface glossy, showing fine, irregular growth lines and some faint, almost obsolete spiral striæ under the lens. Spire conic, the apex obtuse, with typical *Drymæus* sculpture; whorls 5, a little convex, rapidly widening, the last ventricose, (keeled in immature shells). Aperture ovate, large, about half the length of the shell ; outer lip thin, unexpanded ; columella reflexed and appressed above, somewhat excised and slightly subtruncate below.

Alt. 22, diam. 12.5 mill.

*King's and Saboga Is., Bay of Panama* (Cuming).

*Bulinus translucens* Brod., P. Z. S., 1832, p. 31.—Sowb., Conchol. Illustr. f. 11.—*Bulimus* (*Bulimulus*) *translucens* Beck, Index Moll. p. 67.—*Bulimus translucens* Desh., in Lam. An. s. Vert. viii, p. 265.—Pfr., Monogr. ii, p. 195; iii, p. 437; iv, 501; vi, 151; Conchyl. Cab. p. 241, pl. 63, f. 27, 28.—Reeve, Conch. Icon. pl. 13, f. 71:—*Bulimulus* (*Leptomerus*) *translucens* v. Mart., in Alb., Die Hel. (2), p. 222; Biol. Centr. Amer., Moll., p. 250.

This species "when in fine preservation is so translucent that the internal pillar and structure of the shell may be plainly viewed through its glassy surface" (*Brod.*). It has hitherto been referred to *Leptomerus*, but the apical sculpture shows it to belong to *Drymæus*.

Var. *subfloccosus*, n. v. Pl. 24, figs. 26, 27.

Smaller and more slender; whorls 6; later whorls showing a slight irregular malleation under the lens. Translucent whitish, with more or less opaque white strigation, and often some scattered dots; several post-nepionic whorls densely spirally striated.

Alt. 19, diam. 9, length of aperture $8\frac{1}{2}$ mill. (Nicaragua).

Alt. $15\frac{1}{2}$, diam. $7\frac{1}{2}$, length of aperture $6\frac{1}{2}$ mill. (Honduras).

*Nicaragua* (Bridges); *Honduras* (Hjalmarson).

D. PANAMENSIS (Broderip). Pl. 24, fig. 30.

Shell ovate-fusiform, somewhat glossy, diaphanous, pale fulvous. Whorls 6, subventricose; lip slightly subreflexed.

Alt. 1, diam. $\frac{1}{2}$ inch (*Brod.*).

*Isla del Rey* (*San Miguel*), one of the Pearl Islands, and *Taboga Island*, both in the Bay of Panama, on the trunks of large trees (Cuming).

*Bulinus panamensis* BRODERIP, P. Z. S., 1833, p. 105.—SOWERBY, Conch. Illustr., *Bulinus* fig. 25.—*Bulinus panamensis* DESHAYES, in Lamarck, Hist. Nat. des Anim. sans Vert., ed. 2, viii, p. 273.—PFR. Monogr. Helic. Vivent. ii, p. 206.—REEVE, Conch. Icon. v, *Bulimus*, pl. 13, fig. 70.—*Bulimus* (*Bulimulus*) *panamensis* BECK, Ind. Moll., p. 67.—*Bulimus* (*Leptomerus*) *panamensis* ALBERS, Die Helic., ed. I, p. 166.—PFR. in Malak. Blätt. ii, p. 160 (1855).—*Orthalicus* (*Leptomerus*) *panamensis* H. & A. ADAMS, Gen. Rec. Moll. ii, p. 156.—*Otostomus panamensis* MARTENS, Biol. Centr. Amer., Moll., p. 236.

Reeve's figure shows darker obliquely longitudinal tawny streaks on a paler ground. It is probably, as Dr. von Martens remarks, a *Drymæus* rather than a *Leptomerus*, and may prove to be a bandless form of one of the preceding species inhabiting the Pearl Islands.

Subgenus LEIOSTRACUS Albers, 1850.

*Leiostracus* ALBERS, Die Heliceen, 1850, p. 156 (exclusive of all except Brazilian species).—*Liostracus* VON MARTENS, 2d edition of Die Hel., p. 213 (same exclusions), type *B. vittatus* Spix. Not *Liostraca* Burmeister, Handbuch der Entomologie iii, p. 589, 1842 (Coleoptera); not *Leiostraca* H. & A. Adams, Gen. Rec. Moll. i, p. 237, Dec., 1853 (Mollusca); not *Liostracus* Angelin, Palaeont. Suec. ii, 1854 (Trilobita).

Perforate, ovate-pyramidal shells, with the spire somewhat turreted,

straight-sided, the lip narrowly expanded, surface smooth, without spiral striæ; protoconch with excessively fine spiral striæ, but no vertical sculpture except occasionally some coarse, low, hardly noticeable wrinkles. Type *D. vittatus* Spix.

The species are illustrated on plate 14.

Distribution, eastern Brazil. Habits arboreal.

*Leiostracus*, as defined by Albers and retained by von Martens and other authors, was a heterogeneous mass of thin-lipped species from both North and South America. As here restricted, it includes a very natural group of tree snails dominant in the Province of Bahia, Brazil, remarkable for their almost smooth apical whorls, straight-sided and pyramidal spires, and usually conspicuous band or stripe pattern of coloration. The anatomy of the group is wholly unknown; and it is placed under *Drymæus* as a subgenus mainly on account of the general appearance of the shell.

The apical whorls in *vittatus*, *onager*, *vimineus*, *manoeli*, *cinnamomeolineatus* and *perlucidus* show no fine vertical sculpture, but only spiral striæ, very fine and close, usually more or less interrupted by shallow rugosities of the surface, and often wholly effaced in adult shells by superficial erosion. *D. obliquus*, which I have not seen, is said by Dohrn to have a "*ganz fein gegittertes Embryonalende.*" This indicates the close alliance of that species to *Drymæus*, and perhaps its removal from *Leiostracus*.

As naturalists now generally adopt the principle that a name should be written as its author wrote it, even when the customary system of transliteration from Greek to Latin has been transgressed, it would seem that *Leiostracus* may stand, though there is an earlier generic term *Liostraca*, of the same derivation and significance.

D. VITTATUS (Spix). Pl. 14, figs. 1, 2, 3, 4, 5.

Shell umbilicate, oblong-turreted, thin but moderately strong; yellow or corneous-buff, unicolored or variously banded or streaked with dusky reddish brown. Surface glossy, smooth, the growth-striæ faint. *Spire long conic, with straight lateral outlines*, the apex rather obtuse. Whorls 7 to 8, moderately convex, the last well rounded at the periphery and below; sutures impressed.

Aperture oblique, colored within like the outside; peristome white, thin, decidedly but very narrowly expanded at the edge, the outer lip more arcuate above, basal lip well rounded, columellar margin

broadly expanded above, impressed at its junction with the whorl; columella concave below, straight or a little convex above.

Alt. $33\frac{1}{3}$, diam. 14–16, length of aperture $14\frac{1}{2}$ mill.

Alt. $29\frac{1}{3}$, diam. 15, length of aperture 13 mill.

*Provinces of Bahia and Pernambuco* (Spix, Acad. coll.); *forests of Ilheos* (Blanchet); *Forest of St. Gonzales and at Caxoeira, prov. Bahia* (Blanchet, for H. coxeirana); *Bahia* (Ihering, Paz).

*Bulimus vittatus* Spix, Testac. Bras. p. 7, pl. 7, f. 4 (1827).—Desh, in Lam., An. s. Vert. viii, p. 243.—Pfr., Monogr. ii, 105; iii, 342; iv, 403; vi, 51; viii, 65; Conchyl. Cab. p. 259, pl. 70, f. 7–11.—Reeve, Conch. Icon. pl. 44, f. 279.—Hidalgo, Journ. de Conchyl. 1870, p. 47.—*Bulimulus vittatus* Beck, Index Moll., p. 65. —Clessin, Mal. Bl. 1888, p. 166.—Not *Otostomus vittatus* Semper, Reisen in Arch. Philippinen, Landmoll. iii, p. 156, pl. 15, f. 15 (anatomy), specimens from Mexico and Caracas. *Helix coxeirana* Moricand, Mém. Soc. Phys. d'Hist. Nat. Genève, vii, p. 433, pl. 2, f. 7–11 (1836).—*Bulimus coxeiranus* Desh, in Lam., p. 240.—*H. caxoeirana* Moric., Mém. Genève ix, p. 59.—*Bulimus candidus* Gray, in Maria Emma Gray's Figs. Moll. Anim., iii, pl. 302, f. 4 (copy from Moricand), and iv, p. 115 (1850).—*Bulimus omphalodes* Mke., Zeitschr. f. Mal. 1846, p. 144.—Pfr., Monogr. iii, p. 105.

Apparently differs from *D. obliquus* in having the aperture longer and the apical sculpture different. The number of bands varies from 4 to 0, but the uppermost, a line at the suture, is generally absent. It varies considerably in degree of elongation, some shells before me having the body-whorl shorter and more convex than any of those illustrated on my plate. Menke's *B. omphalodes* was founded on short examples, with the aperture relatively larger than in the types, measuring 15 mill. long with a shell length of 31 mill.

The coloring of Spix's type is that shown in fig. 1, streaked, with a basal band. Moricand based his *coxeirana* upon banded shells, and gave names to the several color-forms. But slight systematic importance attaches to these band-varieties, which are as follows: *Vittato-ezonata*, streaked like fig. 1, but bandless; *unicolor*, citron yellow throughout (fig. 4); *trizona*, three dark bands on a light ground (fig. 2); *dizona*, two bands (fig. 5); *nigrescens*, upper two bands united (fig. 3); *purpurascens*, a single subperipheral vinous band.

Hidalgo reports *vittatus* from Rio Janeiro, on the authority of Sr.

Paz; but the specimens were probably purchased or given to him there, not collected, as other naturalists report it solely from more northern provinces.

D. OBLIQUUS (Reeve). Pl. 14, figs. 6–15.

Shell umbilicated, subpyramidal-ovate, the base obliquely produced; rather solid, smooth; pale rose-colored, the last whorl encircled by a single chestnut band. Spire long-conic, rather obtuse. Whorls 7–8, rather flattened, the last shorter than the spire, rotund. Columella subplicate. Aperture a little oblique, suboval: peristome expanded, the columellar margin dilated, vaulted, reflexed.

Alt. 23, diam. 10 mill.; aperture 9 mill. long. (*Pfr.*)

*Province of Bahia* (Cuming, Will). *and Minas Geraes* (Hollerbach). *Brazil.*

*Bulimus obliquus* REEVE, Conch. Icon., pl. 76, f. 551 (August, 1849).—PFR., Monogr. iii, p. 342.—*Bulimulus obliquus* DOHRN, Jahrb. D. Mal. Ges. x, 1883, p. 352, pl. 11, f. 8–15.—MARTENS, Sitzungsber. Ges. Naturforsch. Freunde, Berlin, 1885, p. 191.——*Bulimus jeffreysi* PFR., Zeitschr. f. Mal., 1852, p. 93: Monogr. iii, p. 342; Conchyl. Cab., p. 187, pl. 49, f. 9, 10.

Fig. 14 is typical *obliquus*, and fig. 15 the original *jeffreysi*. Dohrn writes that different as are Pfeiffer's diagnoses of *obliquus* and *jeffreysi*, he is unable to separate the two upon comparing over a hundred specimens. In the various color-varieties the form is sometimes more slender, sometimes more obese, and the aperture varies concomitantly in length, and in being more or less oblique. In those with long, subvertical mouth the columellar margin of the lip is naturally formed somewhat differently than in shorter shells. Common to all the examples is the quite finely latticed and reddish embryonic extremity of the smooth shell. The following color-varieties occur:

1. White, bandless.

2. White or even milk-white or yellowish-white or bluish white or reddish, with a band below the periphery (*B. obliquus*).

3. Straw-yellow, with rose-colored bands so broad that the ground color almost disappears, and either with a brown band below the periphery, or with also a quite narrow brown sutural stripe, frequently demarked by a white line bounding it below.

4. Like no. 2, but having a brown band around the umbilicus and two narrow, brown, band-like series of flecks above the periphery.

5. With three dark bands upon a whitish or yellowish ground (*B. jeffreysi*).

6. With four dark bands, the uppermost from the suture on covering half of the whorls.

7. With four or five bands, the lowest around the umbilicus light brown or dark, the rest always dark; the uppermost and middle ones generally narrow and light brown, the second always lilac or rose, sometimes decidedly wider than the others; and frequently there is a fine, dark sutural line. Measurements of several specimens are:

Alt. 30, diam. 13; aperture, length 12, width 8 mill.

Alt. 27, diam. 14; aperture, length 11½, width 7½ mill.

Alt. 26, diam. 13; aperture, length 12, width 8½ mill.

Alt. 24, diam. 11½; aperture, length 10, width 7 mill.

Alt. 22½, diam. 12; aperture, length 10, width 6½ mill.

This species is undoubtedly distinct from *B. vittatus* Spix. It is doubtful, in my opinion, whether *B. coxeiranus* Moric., placed by Pfeiffer as a synonym of *B. vittatus*, will not have to be removed thence and united with the present species. (*Dohrn.*)

D. CLOUEI (Pfeiffer).

Shell perforate, ovate-turreted, rather solid, striated and sometimes submalleate; white, irregularly marked with streaks, spots and dots of corneous-brown. Spire long-conic, rather acute. Whorls 7, moderately convex, the last scarcely equal to three-sevenths of the total length, subangular, having a corneous band around the impervious perforation. Columella shortly receding. Aperture oblique, sinuate-oval, brownish within; peristome narrowly expanded, the columellar margin dilated above, reflexed, then descending to an obtuse basal angle. Alt. 22, diam. 10 mill.; aperture 10½ mill. long, 6 wide. (*Pfr.*)

*Brazil* (Cloué, in Cuming coll.).

*Bulimus clouéi* PFR.. P. Z. S., 1856, p. 390; Monogr. iv, p. 408.

Very similar in form to *B. obliquus* Rve. (*Pfr.*)

D. ONAGER (Beck). Pl. 14, figs. 16, 17.

Shell perforate, oblong-turreted, thin but rather solid; white, creamy or yellow, with *longitudinal purple-brown stripes* which may continue to the base, or be *interrupted by a basal light zone bordered by dark bands;* the stripes generally irregular or forked above. Surface glossy, smooth except for slight growth-lines. Spire long, apex rather obtuse. Whorls 6⅓ to 7, convex, the last decidedly so.

Aperture oblique, small, showing the external pattern within; peristome thickened, white or tinted, expanded, the columellar margin triangularly dilated above; columella straight and vertical above.

Alt. 25, diam. 13, length of aperture 11 mill.

Alt. 26, diam. 12, length of aperture 10 mill.

Alt. 20, diam. $10\frac{1}{3}$, length of aperture 9 mill.

*Forests of Prov. Bahia, Brazil* (Spix).

*Bulimus zebra* Spix, Testac. Bras. p. 8, pl. 7, f. 5 (not of Brug.). —Desh. in Lam., An. s. Vert. viii, p. 242.—*Helix zebra* Moricand, Mém. Genève, vii, p. 432.—*Bulimulus onager* Beck, Index Moll. p. 64 (1838), based upon Spix's *B. zebra.*—*Bulimus onager.* Reeve, Conch. Icon. pl. 45, f. 284.—Desh. in Fér., Hist., p. 73, pl. 145, f. 10, 11.—Pfr., Conchyl. Cab. p. 167, pl. 50, f. 9, 10; Monogr. ii, 107; iii, 342; iv, 403; vi, 50.—*Bulimus vittatus* Küster, Conch. Cab., pl. 16, f. 16.

*D. onager* is allied to *D. vimineus*, but the aperture is entire and rounded below, while in the other species it is produced and effuse at the lower outer part.

The typical form (fig. 16) has longitudinal stripes, usually quite irregular and often bifurcating near the suture, but extending to the base. This varies to forms having a small uniform brown tract around the columella, or enlarged to cover half or even all of the base.

Color-var. *subtuszonata* n. v. (fig. 17). Base with a wide white zone, bounded by dark bands above and below. In this form the longitudinal stripes are generally broad and bold, and the shell is frequently larger than the typical form, attaining a length of 28 mill.

D. vimineus (Moricand). Pl. 14, figs. 18, 19, 20.

Shell perforate, oblong-pyramidal, rather solid; white or whitish, with *longitudinal stripes of purple-brown extending from suture to base*, some of them often accompanied by ochre-colored stripes; with *sparsely irregularly scattered dark dots*, which are translucent by transmitted light. Surface smooth except for slight growth lines, somewhat shining. Spire high, the apex somewhat obtuse. Whorls 7, moderately convex, *the last obscurely angular at the periphery, in front.*

Aperture oblique, chestnut-colored and streaked within, more or less *produced at the outer basal portion*, like a wide, shallow channel

or spout; peristome thickened and broadly white-edged within, slightly expanded, the columellar margin with a short triangular reflexion above, narrow below.

Alt. 24, diam. 12, length of aperture 11⅓ mill.

*Bahia, Brazil* (Blanchet).

*Helix* (*Cochlogena*) *viminea* Moricand, Mém. Soc. Phys. et d' Hist. Nat. Genève, vi, p. 540, pl. 1, f. 5 (1833?).—*Bulimus vimineus* Pot. & Mich., Gal. du Douai, i, p. 150, pl. 13, f. 19, 20.—Desh. in Lam., p. 242.—Reeve, Conch. Icon., pl. 40, f. 246.—Pfr., Monogr. ii, p. 95; iii, p. 375; iv, p. 444; vi, p. 80; viii, p. 113.—Hidalgo, Journ. de Conchyl., 1870, p. 59.—*Bulimulus vimineus* Beck, Index Moll., p. 64, with var. *normalis* and *leucostoma* (undescribed).

Closely allied to *D. onager;* but the aperture is always produced or channelled more or less at the outer basal portion, there are some ochre-colored stripes among the purplish and white ones, and dots are sparsely scattered over the surface. The pattern of coloring is not so mutable as in *onager*, the variation being in the width of the stripes, greater or less prominence of the ochre coloring, and number of dots. There is wide variation in the shape of the aperture, but the outer lip is shown too arcuate in fig. 20.

Hidalgo reports *vimineus* from Rio Janeiro, on the authority of Paz; but I do not think it inhabits that province.

D. manoeli (Moricand). Pl. 14, figs. 23, 24.

Shell perforate, ovate-conic, rather solid though thin; fleshy- or yellowish-white, usually with indistinct purplish streaks above, with *two rather narrow purple bands, one basal, the other peripheral*, ascending the spire, where it is partially disclosed above the sutures; the upper part of the spire generally corneous. Surface smooth except for slight growth-lines, shining. Spire conic, the apex rather obtuse. Whorls 6½ to nearly 7, moderately convex, the last well rounded.

Aperture oblique, ovate, white with *two bright chestnut bands within*, and often clouded with chestnut above the upper band; peristome white, very narrowly expanded, the columellar margin triangularly dilated above.

Alt. 21, diam. 11⅓, length of aperture 10 mill.

*Bahia, Brazil* (Blanchet, Anthony, Ihering).

*Helix* (*Cochlogena*) *manoelii* Moric., Mém. Soc. Phys. et Hist.

Nat. Genève, ix, p. 59, pl. 4, f. 4, 5 (1838?).—*Bulimus manoelii* Pfr., Symbolæ iii, p. 55; Monogr. ii, p. 110.—Reeve, pl. 48, f. 311.—Deshayes in Fér., Hist., ii, p. 54, pl. 145, f. 12, 13.—*Bulimus coxiranus* Pot. & Mich., Galerie, i, p. 138, pl. 13, f. 1, 2.—*Bulimulus* (*Liostracus*) *manoeli* Clessin, Mal. Bl. 1888, p. 166.

Very variable in the amount of purple or reddish streaking and suffusion above, this species seems to constantly have two purplish bands, invariable in position but showing some variation in width. In some shells there is a wide obscure zone above and adjacent to the peripheral band, and ascending the spire. It is named in honor of a Creole who assisted Blanchet to collect natural history specimens. Fig. 24 was drawn from a specimen received from Moricand.

There is a later *Helix manoeli* of Pfeiffer, which is a synonym of *Pleurodonte* (*Labyrinthus*) *manueli* (Higgins).

D. cinnamomeolineatus (Moricand). Pl. 14, figs. 25, 26, 27, 28.

Shell perforate, ovate-conic, thin but usually rather solid; whitish with numerous narrow, irregular light reddish-brown oblique streaks continuous from suture to base or leaving a small light umbilical area, or nearly uniform white or yellowish throughout, broken by inconspicuous grayish or yellowish oblique streaks. Spire pyramidal with straight lateral outlines, the apex obtuse. Whorls $6\frac{2}{3}$, somewhat convex, *the last with a slight keel sketched around the periphery.*

Aperture oblique, ovate, white or streaked with gray inside; the peristome thin, very narrowly expanded at the edge, columellar margin triangularly reflexed above.

Alt. $21\frac{1}{2}$, diam. $11\frac{1}{2}$, length of aperture $9\frac{3}{4}$ mill.

Alt. $18\frac{1}{2}$, diam. 10, length of aperture $8\frac{1}{2}$ mill.

Alt. 17, diam. 9, length of aperture $7\frac{1}{2}$ mill.

*Province of Bahia, Brazil* (Blanchet and others).

*Bulimus lineatus* Spix, Test. Bras. p. 8, pl. 7, f. 6 (1827).—Desh. in Lam., An. s. Vert. viii, p. 244.—Reeve, Conch. Icon. pl. 62, f. 428.—Pfr., Monogr. ii, p. 109; vi, p. 52. Not *B. lineatus* Brug.—*Helix* (*Cochlogena*) *cinnamomea-lineata* Moricand, Mém. Soc. Phys. Hist. Nat. Genève, ix, p. 60, pl. 4, f. 6, 7 (1838?).—*Bulimus cinnamomeo-lineatus* Pfr., Symbolæ ad Hist. Hel. iii, p. 53; Monogr. ii, p. 109; iii, 343; iv, 407.—Reeve, Conch. Icon. pl. 46, f. 293.—?? Troschel, Archiv für Naturg. 1849, i, p. 231, pl. 4, f. 4 (teeth and jaw).—?? Drouet, Moll. Guyane Francaise, p. 61.

The species upon which Moricand inflicted the more than sesquipedalian name of *cinnamomeolineatus* is usually somewhat smaller than any of the preceding, and *streaked* rather than *striped* with cinnamon brown, or with the streaks obsolete. The peripheral keel, while so slight as to hardly affect the rotundity of the last whorl, is still quite perceptible.

I consider the locality, Guiana, given by Troschel on the evidence of specimens collected by Schomburgk, as in all probability erroneous. Troschel's investigation of the teeth was made on Schomburgk's material, so that this citation also is open to doubt. See Schomburgk's "Reisen in Britisch-Guiana," vol. iii, p. 546. Drouet quotes the species, on the authority of Schomburgk, in his French Guiana catalogue.

D. PERLUCIDUS (Spix). Pl. 14, figs. 21, 22.

Shell perforate, pyramidal, thin but moderately strong; subtranslucent *opaline white throughout*, or with the tip of the spire red-brown. Surface smooth except for slight oblique growth lines and in places some nearly obsolete short spiral impressions. Spire long-conic with straight lateral outlines, the apex somewhat obtuse, usually with a minute terminal dark spot. Whorls 7 to $7\frac{1}{2}$, the first smooth, the rest slightly convex, *last whorl decidedly keeled at the periphery*, moderately convex above and below the keel.

Aperture small, oblique, ovate; peristome narrowly expanded at the edge, the columellar margin triangularly reflexed above.

Alt. $23\frac{1}{2}$, diam. $12\frac{1}{2}$, length of aperture 10 mill.

Alt. 21, diam. 11, length of aperture $8\frac{2}{3}$ mill.

*Province of Bahia, Brazil* (Blanchet, Will).

*Bulimus perlucidus* SPIX, Test. Bras. p. 7, pl. 7, f. 2 (1827).—DESH. in Lam. An. s. Vert., viii, p. 248.—PFR., Monogr. ii, p. 204; iv, p. 405; vi, p. 51.—*Bulimulus perlucidus* BECK, Index Moll. p. 67.—DOHRN, Jahrb. d. D. Malak. Gesellsch. x, 1883, p. 351.—*Bulinus opalinus* SOWB., Conch. Illustr. f. 47; Beechey's Voy. "Blossom," p. 144, pl. 38, f. 8.—*Bulimus opalinus* PFR., Monogr. ii, p. 107; iii, p. 347.—REEVE, Conch. Icon. pl. 58, f. 394.—HIDALGO, Journ. de Conch. 1870, p. 47.—*Helix* (*Cochlogena*) *angulosa* FÉR., Prodrom. p. 54, no. 402 (according to Beck).—MORICAND, Mém. Genève vii, 435.—*Bulimulus angulosus* BECK, Index Moll. p. 64.—*Liostracus angulosus*, FFLD., Verh. Zool.-bot. Ges. Wien, xix, 1869, p. 874.

Aside from some resemblance to *Oxychona pileiformis*, already noticed by Dohrn, this species resembles no other South American snail, though it is obviously related to *D. cinnamomeolineatus* and its allies. Out of nine specimens before me, two lack the reddish tip at the apex, and one has a light red line bordering the suture below, and about 1 mill. wide. As Dohrn remarks, the whorls vary in convexity in different specimens. He gives the following measurements of the largest and smallest specimens: Alt. 30, diam. 13, length of aperture 13 mill.; alt. 19, diam. 10, length of aperture 10 mill. The soft parts are said to be light green with yellowish sole.

On the authority of Paz, Hidalgo records this species from Rio Janeiro ; but I am disposed to believe that some one in that city gave or sold it to Paz with a number of other north Brazilian snails. There is no sufficient evidence to show that any *Leiostracus* occurs living in the province of Rio Janeiro.

## Subfamily ORTHALICINÆ.

Shell varying from ovate to oblong-conic, wholly imperforate, with solid axis, the aperture ovate, toothless, columellar lip closely appressed, the lip-ends distant.

Jaw composed of about 15 broad plates, overlapping or imbricating as usual in *Bulimulidæ*, the median plate usually subtriangular. Radula peculiar, the basal-plates short, oblong or quadrate, the cusps short and blunt or rounded, gouge-shaped throughout, or a few median teeth have pointed cusps ; no division into ectocone, entocone and mesocone except on the marginals, where it is not strongly indicated.

Genital system simple, except that there is a small appendix or accessory gland about midway on the penis, rarely replaced by a circular swelling. No flagellum.

Oviparous. The eggs are elliptical, brown or whitish, and roughened by distinct granules.

Distribution : tropical and subtropical America. Most of the species live on trees and bushes, but probably *Hemibulimus* and part of *Orthalicus s. str.* are terrestrial.

This subfamily differs from the *Bulimulinæ* in the imperforate, not even rimate shell, the broad plates of the jaw and their small number, the highly modified, gouge-shaped teeth, and the presence of an appendix on the penis. It is a very natural group, comprising several quite closely-allied genera.

The form of the cusps of the central and inner lateral teeth varies within several of the genera, which are based almost wholly upon characters of the shell. In *Oxystyla*, *Liguus* and *Orthalicus* there are species with the median teeth lance-shaped and others with them blunt. It is not possible to divide the series in any rational manner, using this character as a basis.

The fundamental color-pattern consists of five spiral bands (generally reduced to three) and numerous longitudinal stripes. The modifications of pattern are further discussed under the several genera.

In the subdivision of the *Orthalicinæ* into genera, there has been wide divergence of opinion; but few who have occasion to study extensive series will dissent from the view that the fundamental division of the group cannot be based upon the lanceolate or obtuse form of the median teeth, nor upon the truncate or continuous condition of the columella, nor upon the simplicity or thickening of the outer lip. These characters all intergrade imperceptibly, sometimes even within the limits of one single species. A far more stable feature is found in the sculpture of the nepionic shell; and I would divide the subfamily primarily into (1) forms with the ante-natal shell pitted like a thimble, and (2) those in which it is smooth or slightly wrinkled longitudinally. The senior name for the first series of species is *Orthalicus* of Beck, 1837. That for the second series is *Liguus* of Montfort, 1810.

These two groups are easily of generic rank; but when further subdivision into genera is attempted, it is obvious that we are dealing with groups of less systematic value than the genera of *Bulimulinæ* recognized in this work. The usage of most conchologists in recent years, however, has been to recognize two or three genera within the group with smooth early whorls; and keeping in mind the fact that their differences are not of much significance, it may be best to adopt some further division. I would, therefore, arrange the genera and subgenera thus:

I. Early whorls pitted, ORTHALICUS, with the subgenus *Metorthalicus*.

II. Early whorls smooth or nearly so,

LIGUUS, with subgenera *Corona* and *Hemibulimus*.

OXYSTYLA.

PORPHYROBAPHE.

Or, to show more clearly the true rank and relationship of the groups:

- Orthalicus
  - *Orthalicus* s. str.
  - *Metorthalicus*.
- Liguus
  - *Liguus* s. str.
  - *Hemibulimus*.
  - *Corona*.
- Oxystyla
  - *Oxystyla* s. str.
  - *Porphyrobaphe*.

*Orthalicus*, in the sense here intended, includes South American species only, the restricted subgenus pertaining to *O. gallina-sultana* and its immediate allies; *Metorthalicus* being a new subgenus for species with pitted apex and thick or reflexed lip.

*Liguus* may well include *Corona* and *Hemibulimus* until some characters of importance are found to separate them. The nepionic shell generally has some longitudinal wrinkles, and the columella is frequently truncated below.

*Oxystyla* is the earliest name for the so-called Orthalicus of Mexico and the West Indies, the type being the common *O. undatus* Brug. The group *Porphyrobaphe*, type *iostoma*, is rightly only a subordinate group to *Oxystyla*, toward which it bears a relation parallel to that held by *Metorthalicus* toward *Orthalicus*. On account of its considerable superficial modification, *Porphyrobaphe* will probably be considered to rank as a genus, though its claims to that position are presumptuous.

It will be seen that in any case, the *B. undatus* group cannot be called "*Orthalicus*." If *Oxystyla* be not recognized as a valid genus, the species will revert to *Liguus*, its next of kin.

## Genus OXYSTYLA Schlüter, 1838.

*Oxystyla* Schlüter, Kurzgefasstes systematisches Verzeichniss meiner Conchyliensammlung (Halle, 1838), p. 7; Sole species *undata* Schlüt. = *B. undatus* Brug.—*Zebra* Shuttleworth, Notitiæ Conchologicæ, i, p. 60 (1856).—Pfr., Nomencl. Helic. Vivent., 1878, p. 258.—*Orthalicus* and *Bulimus* sp. of some authors.—*Ortalichus* v. Martens, Biologia Centrali-Americana, mollusca, p. 179 (May, 1893).

For anatomy, see Crosse & Fischer, Miss. Scient. Mex. Moll., p. 429; Binney, Ann. N. Y. Acad. Sci. iii, p. 128; Strebel, Beitr. Mex. Land- und Süsswasser-Conchyl., Heft v; Semper, Reisen in Archip. Phil., Landmoll., p. 248.

Shell imperforate, ovate-conic, usually rather thin but strong, composed of 5 to $8\frac{1}{2}$ moderately or slightly convex whorls; apex obtuse, *the earlier 2 or 3 whorls smooth;* aperture ovate, oblique, rounded below, the *lip simple and unexpanded; columella slender*, straight or with a moderately convex fold, *not truncated at base.* Coloration usually of longitudinal, waved or zigzag stripes, more or less modified by three equidistant spiral bands.

Type *Bulimus undatus* Brug. Distribution, tropical and sub-tropical America.

Genitalia without accessories except a small lobed gland upon the penis, rarely obsolete. Teeth usually with rounded cusps, but those of the median teeth are rarely pointed, and in some species, such as *O. princeps*, the cusps vary in different individuals from long and lance-shaped to short and obtuse.

The fundamental color pattern is a combination of three bands at equal distances on the last whorl, with longitudinal stripes, the bands being probably the more fundamental and older element. These bands are apparently the remnant of an original five-banded pattern, such as may be seen in various forms of *Drymæus;* and following the usual notation, a banded *Oxystyla* has the band formula 02340. In some species and races, such as *O. melanocheilus*, *tricinctus*, *floridensis*, this pattern stands alone; in others, such as *reses*, *ferussaci deceptor*, it is found in combination with stripes; while in the striped forms without distinct bands, their position is indicated by a sinuation, angle or spot in the stripes, showing the fundamental impress of the tendency to trifasciation in the organization of the animal. Striped species seem to have a tendency to revert to the trifasciate condition; and the full recognition of the several "*melanocheilus*" forms (pl. 18) occurring in Mexico, Central and South America, and Florida, as parallel modifications of several flammulate specific or varietal stocks, and wholly independent of each other, is the main contribution I would make to the body of general ideas bearing on the study of species and races. In a few forms, such as *O. longa*, the bands seem wholly lost, the stripes being straight. In *O. zonifera* there is a tripartite division in the general color tone of the shell.

Varices, as the black or dark streaks reminiscent of former peristomes or "resting periods" may be called, are doubtless directly due to climate; their number and spacing depending upon the two factors of *rate of growth of the individual*, and frequency or rarity of

of its partial or complete *interruption by dry periods.* The influence of these dry seasons is to check growth; the dark pigment, which during rapid growth in seasons of humidity is distributed in flames or bands, is concentrated in the narrow, slowly forming lip-streak; finally growth ceases, the aperture is firmly sealed to the bark of a shrub or tree by a thick epiphragm, and metabolism is reduced to a minimum until the recurrence of wet weather abruptly initiates a new period of active growth.

Each varix corresponds to a light or imperfectly pigmented sigmoid streak on the parietal callus, apparently caused by a temporary deficiency of coloring matter upon the resumption of growth after a resting period. Specimens having varices upon the latter portion of the last whorl show these pale streaks on the callus. From the foregoing, it will be obvious that local climatic conditions govern the development of varices to a great extent; and these markings are therefore characteristic of the local races into which *Oxystyla* everywhere splits.

The sculpture varies somewhat in different species, consisting of spiral striæ and oblique malleation. In *O. undata jamaicensis* it is almost or entirely obsolete; in *obducta* it is very faint; in *princeps* sharp, irregular, the striæ anastomosing or descending at short intervals in a series of steps. In *O. bensoni* the spiral lines are strongly developed, decussating the longitudinal striæ.

None of the species, so far as now known, are common to South America and Mexico or Central America; the supposed Central American *obducta* being a form of *O. princeps*, and the Colombian and Venezuelan shells referred by von Martens and Strebel to *O. ferussaci* and *O. tricinctus* prove to belong to *O. maracaibensis.*

The Middle American species have been monographed by Fischer and Crosse, later by Strebel and Pfeffer (1882), whose work contains a great amount or original and valuable information, and lastly by Dr. E. von Martens (1893) who gives an excellent and succinct account, marred only by an insufficient appreciation of the status of the "melanocheilus" forms, and the inclusion of *O. obducta*, a species not occurring in North America.

The species are all variable. Those of "Mexico and Central America of the *O. undata-princeps* group are nearly allied *inter se*, and it may be questioned whether they do not run one into the other, so much so as to be regarded as varieties of one and the same species.

Most authors, however, including Shuttleworth, in his valuable monograph, have treated them as distinct, and I adopt this plan; but I confess that in some cases it is very difficult to decide to which species a single specimen may belong." The material I have studied fully supports Dr. von Martens' remarks just quoted. It should be added that there are several species of the *undata-princeps* group, such as *obducta* and *longa*, which are readily distinguishable and undoubtedly "good" species, and in fact forms occur of every grade between species and mere local races. There is no particular advantage in lumping them under one name, as the forms are definitely limited geographically, and the knowledge already gained of their variation and distribution would be largely lost by lumping all of them under one or two of the old names.

The species are herein grouped geographically under (1) Mexican and Central American, (2) species of the Antilles and Florida, and (3) South American. This arrangement separates some closely-allied forms, such as *O. undata*, *maracaibensis* and *ferussaci*, but is probably more convenient than a strictly natural sequence.

The oldest description of a species of this genus, *Buccinum zebra* Müller, Vermium Terrestrium et Fluviatilium, ii, p. 138 (1774), would apply to various species, but is so vague that it cannot be fixed upon any one of them. As illustrations of his species, Müller cites numerous figures: Lister, pl. 11, f. 6 = *Perideris;* 9, 4 and 10, 5 = *Limicolaria?*; 580, 34 = *Orthalicus princeps?* or *undatus?* young; 578, 33 = *Achatina fulica;* Petiver, Gazophyl. 44, 7 = a uniform white *Oxystyla*, possibly *O. maracaibensis* f. *imitator*; Seba, Thesaurus, pl. 39, f. 54, 55 = *O. ferussaci?* and f. 50, 51 = *O. melanocheilus*, *tricinctus* or *imitator*.

The terms of the specific description exclude *Achatina*. The name practically covers the entire genus *Oxystyla*, with similarly marked species of *Limicolaria;* but in my opinion neither the *melanocheilus*-like form selected by Shuttleworth, nor the *O. undatus* of Bruguière can fairly be called *zebra;* the first because Müller's name and description point rather to a zebra-striped and not a three-banded shell, the second because *undatus* was the first species to be segregated from Müller's composite group, and hence has a valid claim to retention.

There is a specimen in Müller's collection which Mörch took for the type, apparently either *melanocheilus*, *tricinctus* or *imitator;* but Müller states that the type is in Spengler's collection.

I would therefore uphold the decision of Dr. von Martens (Malak. Blätter xii, p. 44, 1865), that the name *zebra* be wholly given up. The data are too indefinite to permit us to fix upon any of the modern species as the true *zebra* of Müller, either by the process of elimination or otherwise.

It should be mentioned that Messrs. Crosse & Fischer, not recognizing the right of Bruguière to dismember a composite species, have arrived at the conclusion that the name *zebra* was "avec une certitude presque complète" based upon the Antillean form, and should replace that of *undatus*. Their remarks on the subject are worthy of careful consideration, in which, however, the "*presque*" should receive due attention.

*Agatina variegata* Rafinesque, Enumeration and Account of some remarkable Natural Objects, etc., p. 3 (1831), Binney & Tryon's reprint, p. 68, is an unidentifiable species of *Oxystyla*.

*Zebra loxensis* Miller = *Strophocheilus hartwegi* Pfr., vol. x, p. 52.

*Antillean Species.*

O. UNDATA (Bruguière). Pl. 27, figs. 16–26.

Shell ovate-conic, varying from ventricose to elongate, rather solid and strong, wholly denuded of cuticle or with it thin and inconspicuous; white or brownish, with numerous irregular undulating longitudinal stripes, often forked above, and three frequently-interrupted spiral bands, often indistinct; apex white or brown-tipped. Surface with irregular growth-wrinkles, more or less puckered or plicatulate below the suture, but showing *no spiral striation on the last whorl*, or only the faintest indication of it in places. Whorls $6\frac{1}{2}$ to nearly 7, moderately convex.

Aperture ovate, white with bluish or brown dark markings inside, oblique; peristome thin, narrowly edged with brown; columella oblique or subvertical, white, the parietal callus varying from dark chestnut to very pale.

*Antilles, Southern Florida.*

A species of peculiar distribution, closely allied to *O. maracaibensis* Pfr., and distinguished from allied Mexican forms chiefly by the obsolescence of the spiral striation. Several well-marked geographic races are indicated by the extensive series of specimens examined, as follows:

Typical UNDATA. Pl. 27, figs. 16, 17, 18.

The terms of Bruguière's description agree best with specimens before me from Trinidad, collected by Mr. *Guppy*, from the Bahamas, *Bendall* and *White*, and from St. Thomas, *Strebel*. The ground-color is pale brownish-yellow or white; the stripes are purplish-brown, *rather wide in the median region of the last whorl*, and mostly forked above, and on the penultimate whorl often spread into blotches, as in *O. princeps;* they do not continue to the base, there being *a lighter basal area;* blackish-brown varices narrow, two or three on the last whorl; the three bands may be seen on some part of the last whorl, though often not distinct; but on the spire the band above the middle is usually conspicuous, though narrow, and the edge of another may often be seen in the suture. *The summit of the first whorl is dark or blackish-brown.* Columella *subvertical, the white part nearly straight. Parietal wall rich chestnut-brown.* Surface often rather coarsely and shallowly plicatulate.

Alt. 51, diam. 31, longest axis of aperture 30 mill.

Alt. 49, diam. 26½, longest axis of aperture 27 mill.

*Trinidad* (R. L. Guppy); *Union Island, Grenadines* (C. D. Stewart); *Cariacou, Grenadines* (Sir R. Rawson); *St. Thomas* (Strebel); *Andros* (White) and *New Providence* (Bendall), *Bahamas.*

*Bulimus undatus* BRUG., Encycl. Méth. i, p. 320 (1792).—*Orthalicus undatus* BLAND, Amer. Journ. of Conch. iv, 1868, p. 185.—GUPPY, Journ. of Conchology vii, 1893, p. 217.—*O. ferussaci-undatus* STREBEL, Beitr. Mex. Land- und Süsswasser-Conchylien v, p. 24, pl. 2, fig. 10.—*Bulimus zebra* GUPPY, Ann. Mag. Nat. Hist. (3), xvii, 1866, p. 48; Proc. Scient. Asso., Trinidad, 1866, p. 16.—*Orthalicus zebra* CROSSE, Journ. de Conchyl., 1890, p. 41 (peculiar synonymy).—E. A. SMITH, Journ. of Conchology viii, 1896, p. 240.—*Achatina undulata* GUILDING, Zoölogical Journal iii, p. 531 (1828?).

One specimen from Union Island, Grenadines, is before me, agreeing in all respects with the Trinidad form. Mr. Smith also reports it from the adjacent Cariacou Island, though exactly what form occurred there I do not know (*O. zebra*, Proc. Malac. Soc. Lond. i, p. 321). As Union Island was the locality of Guilding's *Ach. undulata*, and the description tallies well with the present form, that name is in all probability a synonym.

Mr. E. A. Smith also reports this species from St. Vincent, on the

authority of specimens in the collection of Sir Rawson Rawson, which he received from the late Thomas Bland (*O. zebra* Müll., Proc. Malac. Soc. Lond. i, p. 306).

This species has been reported from St. Thomas by Strebel, who gives the following notes: *O. undatus*, form *B*; form from St. Thomas. A specimen in the Berlin Museum, from Gruner. It differs from those of Jamaica in the more ventricose form, and the less oblique, sinuous columella. The flame-marking continues over half the last whorl, the general coloration being characteristic of the species; embryonic whorls with a small brown tip; the peripheral and upper spiral bands are well developed on the latter half of the last whorl. Alt. 60.1, diam. 36.3, length of aperture 35 mill.; whorls $6\frac{1}{2}$. (Beiträge Mex. Land- und Süsswasser-Conchylien, v. p. 27).

The locality lacks verification by other observers, and can hardly be accepted unreservedly until confirmed, although in view of the occurrence of the species in the Bahamas, there is nothing intrinsically improbable in the record. It is evidently the typical form of the species.

Mr. Bendall reports the species living high up in large trees in New Providence, Bahamas (*O. zebra* Brug., Bendall, Proc. Malac. Soc. Lond. i, p. 293). He very kindly sent me a young specimen, which proves to be like the Trinidad form in markings and apex, and the dark parietal callus.

A specimen from Andros, Bahamas (J. J. White), before me belongs also to the dark tipped, chestnut calloused Trinidad form. It would seem therefore that in the Bahamas, *O. undata* belongs to the typical form, not to the Jamaican or Floridian races. Whether man's intervention has been a factor in the distribution of *O. undata* is problematic.

Var JAMAICENSIS n. v. Pl. 27, figs. 19, 20, 21, 22, 23.

Form more elongated; solid; *destitute of cuticle; white* with numerous *bluish-black or bluish-brown* stripes, mostly *continuing on the base* to the columellar callus; bands variable, but rarely so conspicuous on the spire as in Trinidad shells; *apex white;* aperture showing blackish bands and streaks within, more or less distinctly, on a white ground; the lip black or dark brown; *parietal wall with a thin wash of diluted chestnut*, or if it be moderately dark, there is *a white zone around the insertion of the columella;* columella a little sinuous or concave.

Alt. 50, diam. 27½, longest axis of aperture 28 mill. (Kingston).

Alt. 70, diam. 39, longest axis of aperture 40 mill. (Yallahs).

Alt. 59, diam. 32, longest axis of aperture 33 mill. (Yallahs).

Alt. 53½, diam. 27, longest axis of aperture 28½ mill. (Yallahs).

Jamaica: "Rock Fort," etc., *near Kingston* (Gloyne, Feilden, W. J. Fox, C. W. Johnson); *east of Kingston*, and *Hope River* (Henderson & Simpson); *Yallahs* (U. C. Smith). Transported from near Kingston to the *Suburbs of Bridgetown and on Pelican Island, Barbados* (Feilden),

*Bulimus zebra* Müll., C. B. Adams, Contrib. to Conch. no. 3, pp. 40, 48; Catalogue of Land Shells which inhabit Jamaica, 1851, p. 184.—*Orthalicus zebra* (Müll.), E. A. Smith and H. W. Feilden, Ann. Mag. Nat. Hist. (6), viii, 1891, p. 253 (exclusive of reference to Reeve).—Crosse & Fischer, Miss. Scient. Mex., Moll., p. 441 (exclusive of much of the synonymy and distribution), pl. 18, f. 8 (epiphragm).

*Orthalicus undatus* var. *a*, Shuttleworth, Notitiæ Malacologicæ i, p. 63, pl. 3, f. 4.—*Orthalicus undatus* Brug., Gloyne, Journ. de Conchyl., 1875, p. 120.—W. G. Binney, Annals of the Lyceum of Nat. Hist. of New York xi, p. 41, and also the notes on *genitalia* (and probably jaw and dentition) of *undatus* in Terr. Moll. v, p. 410, and Man. Amer. Land Shells, p. 440.—Strebel, Beitr. Mex. Land- und Süsswasser Conchylien v, p. 26, form A, pl. 2, f. 11 (shell of a Jamaican specimen).—Tryon, Amer. Journ. Conch. iii, p. 166, pl. 13 (9), f. 1.—Henderson, Nautilus viii, p. 19, 1894.

More or less doubtfully pertaining to the Jamaican form: *Bulla zebra* δ, Gmelin, Syst. Nat. (13), p. 3431, based on *Zebra mülleri* Chemnitz, Syst. Conch. Cab. ix, pt. 2, p. 24, pl. 118, f. 1015, 1016. See also new edition, *Bulimus*, pl. 2, f. 4, 5.—*Helix* (*Cochlostyla*) *undata* Férussac, Prodr. no. 337; Histoire, pl. 114, f. 5, 6.—*Orthalicus undatus* (in part) Beck, Index, p. 59.—? *Orthalicus zebra* O. F. Müller, Strebel, Beiträge Mex. Land- und Süsswasser-Conch. v, p. 24, pl. 11, f. 20.

The dead, lustreless, and rather rough surface of most Jamaican shells is apparently due to the extreme dryness of the climate of the southern portion of the island. East of Kingston the species is locally very abundant, on trees, but its range is confined to a small area. This limited range, with the fact that the species lives mainly near human habitations, caused C. B. Adams to suggest that it had been intro-

duced into Jamaica by the agency of man. Against this view is the strong individuality of the Jamaican race. I am informed by Professor Cockerell that materials which have been traced to flood-debris of the Orinoco, are commonly cast upon the southern coast of Jamaica near Kingston. I would suggest from this circumstance that *O. undata* may have been carried from Trinidad to Jamaica sealed to the projecting limb of a floating tree. If so, the Floridian and Bahama colonies are possibly traceable to similar flood waifs.

"It is very common in the neighborhood of Kingston, Jamaica, but seems confined to that area, and may be seen clinging in hundreds to the prickly-pear plants bordering the roads. I have not met with it in any other part of that island. In 1889 I brought a small basket full of them from Jamaica to Barbados; but being on arrival placed in quarantine, on Pelican Island, I turned them out there on the bushes. Subsequently I found them in limited numbers already introduced to gardens in the suburbs of Bridgetown." (*Col. H. W. Feilden.*)

Var. RESES (Say). Pl. 27, figs. 24, 25, 26.

Form *ventricose; thin and light*, less solid than the Jamaican or Trinidad races. White or slightly brown-tinted, this tint deepening near the lip or behind the later varices; stripes few, purplish brown, running with the growth-lines, and mingled with streaks of the same or a bright rust color, the stripes and the streaks often interrupted between the bands, and mostly not extending below the lower one; varices rather numerous, usually 3 or 4 on the last whorl; *three spiral bands strongly indicated; apex black or chestnut.* Aperture large, *showing the varices, bands and streaks vividly inside;* columella straightened above; *parietal callus chestnut* with pale sigmoid streaks, and *no white area around the axis.*

Alt. 52, diam. 31, longest axis of aperture 31 mill. (Sugar Loaf Key.)

Alt. 46, diam. 30, longest axis of aperture 27½ mill. (Sugar Loaf Key.)

*Sugar Loaf Key, Florida* (F. E. Blanes); *Key West* (Rugel, Simpson).

*Bulimus reses* SAY, New Harmony Disseminator, Dec. 28, 1831 (as synonym of *B. undatus*); Say's reprint, p. 25; Binney's reprint, Complete Writings of Thomas Say, p. 39.

*Bulimus zebra* d'Orbigny, in Ramon de la Sagra's Histoire Phys., Polit. et Nat. de l' ile de Cuba, Moll., i, p. 174 (exclusive of synonymy and distribution), pl. 6, f. 9, 10. Conf. Arango, Fauna Malac. Cubana, p. 130.—*Bulimus zebra* A. Binney, Terrestr. Moll. N. A. ii, p. 271 (in part), pl. 54, lower figure only (good).

*Orthalicus undatus* var. B, Shuttleworth, Notitiæ Malacologicæ i, p. 63, pl. 3, f. 5 (a Key West specimen coll. by Rugel).—*Orthalicus undatus* Binney & Bland, Land and Fresh-water Shells of N. A., i, p. 217 (exclusive of part of synonymy and remarks), fig. 372.—W. G. Binney, Terrestr. Moll. v, pp. 406, 408 (with same reservation), fig. 285 (jaw), pl. 54, lower figure only; pl. xvi, f. M, pl. x, f. H; (radula); Manual of American Land Shells, p. 438 (same exclusions), f. 482.—Simpson, Proc. Davenport Acad. Nat. Sci. v, p. 67.

Very readily distinguished from the Jamaican race by its more ventricose form, lighter texture, more lively color both outside and within the aperture, the greater prominence of the three bands, and the dark apex and parietal wall. It is less solid than the Trinidad race, brighter colored, with more prominent bands and varices.

I have revived the name proposed by Thomas Say for this form, as it is what his brief remark under *B. undatus* indicates. In formally introducing and defining the race, I select the form found on Sugar Loaf Key as the type.

D'Orbigny figures exactly this form in de la Sagra's History of Cuba, but Arango repudiates it as a Cuban species, in his Fauna Malacologica Cubana, p. 130.

Var. floridensis Pilsbry. Pl. 18, figs. 7, 8, 9, 10, 11, 12, 13.

Ventricose, moderately solid, white, often becoming tinted with light brown on the latter part of the last whorl; *lacking longitudinal flames*, but with a few tawny streaks and 1 to 3 blackish varices (on the whole shell); *encircled by three brown or purplish bands*, the basal one generally widest, the peripheral narrow, and the upper one often subobsolete; *tip of the apex dark;* aperture showing the bands, but usually no varices inside; lip and the broad *parietal callus deep chestnut colored;* columella white, straight.

Alt. 52, diam. 31, longest axis of aperture 31 mill.

Alt. 48, diam. 28, longest axis of aperture 27 mill.

*Florida: near Cape Sable* (Hemphill, Simpson); *Key Biscayne* (Binney); *Indian Key* (Wurdemann).

*Bulimus zebra* W. G. Binney, Terrestr. Moll. iv, p. 225, pl. 78, f. 12.—*Orthalicus zebra* Binn. & Bland, Land and Fresh-water Shells of N. A., i, p. 216, f. 370 (exclusive of synonyms and fig. 371).—*Orthalicus melanocheilus*, specimens from Indian Key, only, Crosse & Fischer, Miss. Scient. Mex., Moll., p. 458.—*O. undatus* var., W. G. Binney, Terrestr. Moll. v, p. 410, f. 286, specimen from Key Biscayne; Man. Amer. Land Shells, p. 440, f. 483; Fourth Supplement to Terrestr. Moll. v, Bull. Mus. Comp. Zool. xxii, no. 4, p. 201, pl. 2, f. 4.—Simpson, Proc. Davenport Acad. Sci. v. p. 67.—*O. melanocheilus* var. *floridensis* Pilsbry, Proc. Acad. Nat. Sci. Phila. 1891, p. 317, fig. (Aug., 1891); Nautilus viii, pp. 37, 38, fig.; p. 57.

Not *O. zebra* of Müller or Shuttleworth; not *O. melanocheilus* Valenciennes; not *O. undatus* Bruguière.

Closely allied to *O. undata reses*, from which it differs in the absence of longitudinal flames and the far smaller number of black varices.

Quite similar to this variety are *O. melanocheilus, O. ferussaci tricincta* and *O. longa strebeli* of Mexico, and *O. maracaibensis imitator* of Venezuela and Colombia. They are parallel modifications of various more or less diverse flammulate species.

It may prevent confusion to place on record here the identity of the specimens figured in the most used works on the United States fauna. In Terrestrial Mollusks iii and v, pl. 54, the lower figure is *O. undata reses;* the two side figures are young *O. princeps;* the upper figure is unknown, the heavy columella being unlike any species known to me, and very unlike *undatus*. In Terrestrial Mollusks iv, pl. 77, fig. 13 is typical *O. princeps;* pl. 78, fig. 12 is *O. undata floridensis*. In the Manual American Land Shells, fig. 480 is *O. princeps*, and the paragraph at the foot of p. 439 beginning "The most beautiful form of the species" also describes *princeps*. Fig. 482 is *O. undata reses;* fig. 483 is *O. undata floridensis*, and fig. 484 is correctly labeled *O. melanocheilus*. In Tryon's monograph, American Journal of Conchology iii, pl. 13, f. 1 is *O. undata jamaicensis;* fig. 2 is *O. undata reses;* fig. 3 is *O. longa uhdeana*. I have examined the specimens figured.

*Mexican and Central American Species.*

*a.* Shell white, yellow or pale brownish with 0–3 spiral bands, *no longitudinal stripes* except the varices, or streaks left by former peristomes.

*b*. Varices few, gray; apex and peristome white; no bands; surface plicatulate. *leucochilus*, p. 129

*b*[1]. Varices few, blackish, the peristome also dark. *tricincta*, p. 120

*b*[2]. Varices numerous, several on the last whorl, and blackish like the peristome; bands 0–2. *melanocheilus*, p. 122

*a*[1]. Shell rather thin, with longitudinal stripes in addition to variceal streaks.

*b*. Varices few, narrow, 1 or 2 on the whole shell.

*c*. Last whorl without spiral bands; stripes 2- or 3-forked above, widening into broad blotches above the periphery; last whorl large. *princeps*, p. 113 *zonifera*, p. 123

*c*[1]. Similarly blotched, but with 2 obscure bands below; form more slender and acuminate. *livens*, p. 118

*c*[2]. Last whorl with thrice angulated narrow continuous stripes. *crossei*, p. 116 *trifracta*, p. 115 *uhdeana*, p. 129

*c*[3]. Last whorl with a peripheral band of oblong blackish, alternating with buff spots; mottled; 2 narrow bands on spire; shell large, with long, straight columella. *deceptor*, p. 116

*c*[4]. Last whorl with simple, rarely forked or zigzag brown stripes, crossed by three spiral bands. *ferussaci*, p. 119

*c*[5]. Last whorl with a light zone below the suture and another around the base, the wide intervening belt darker, with wider stripes. *zonifera*, p. 123

*c*[6]. Shell large, with close, pale violaceous nearly straight stripes, and few varices. *livida*, p. 124

*b*[1]. Varices 1–4, narrow, a perceptibly paler zone on the closely streaked shell below the suture. *zonifera*, p. 123

*a*[2]. Shell solid and strong with longitudinal stripes or spots, and varices.

*b*[2]. Varices rather wide, the lip very broadly dark-bordered inside; shell *heavy and thick*, boldly striped above, generally becoming rich reddish-brown on the last whorl. *ponderosa*, p. 130

*b*[3]. Varices usually 4 to 6, wide and prominent; lip generally rather broadly dark-bordered; usually a white subsutural band; shell solid.

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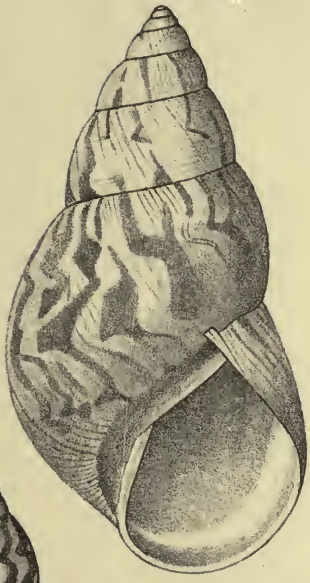

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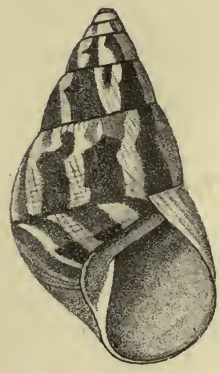

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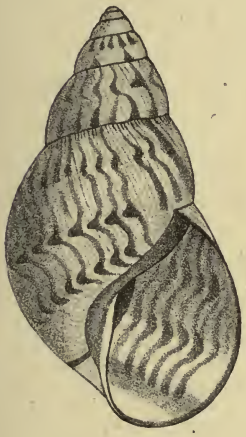

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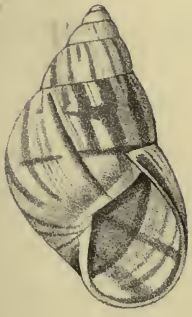

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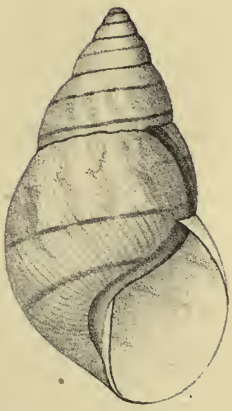

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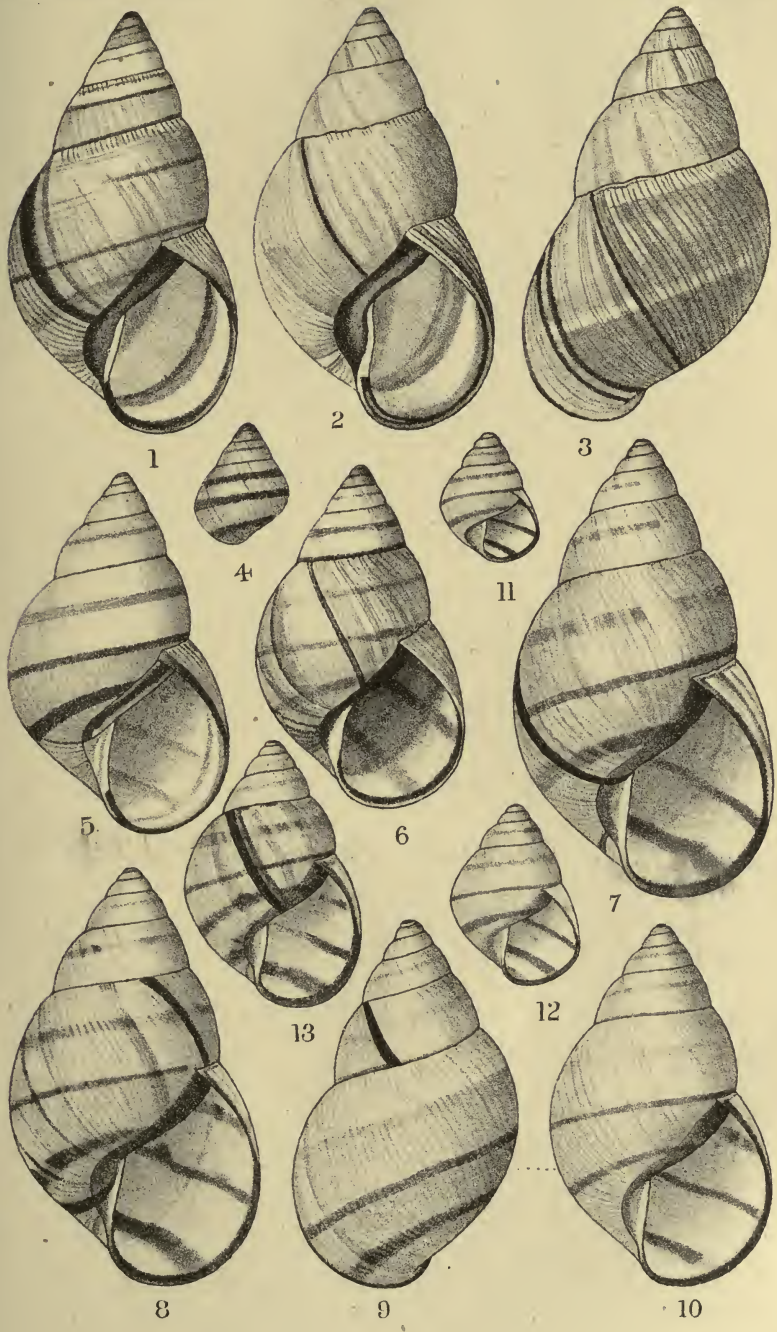
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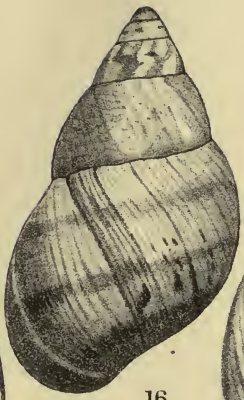

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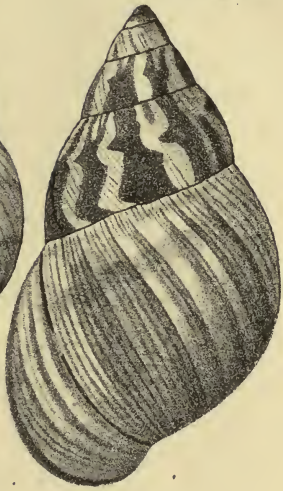

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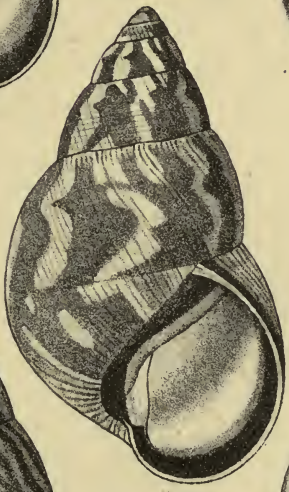

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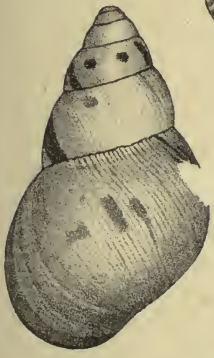

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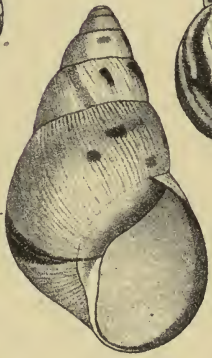

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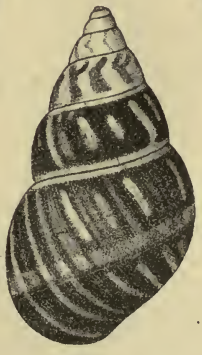

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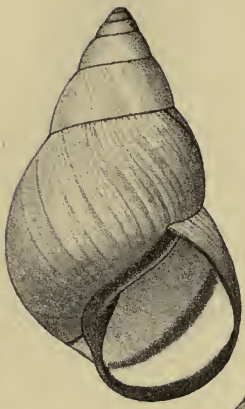

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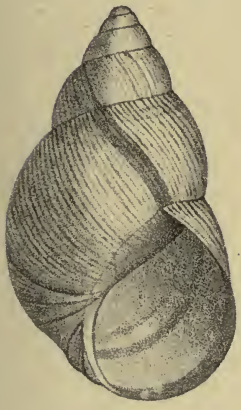

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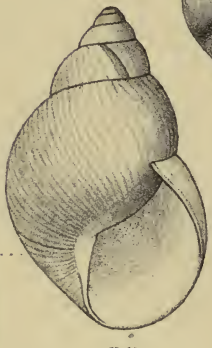

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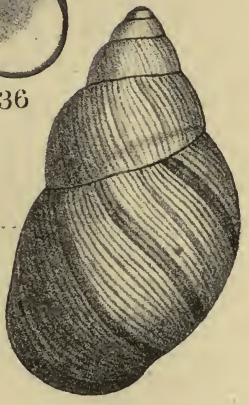

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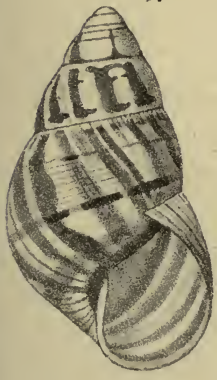

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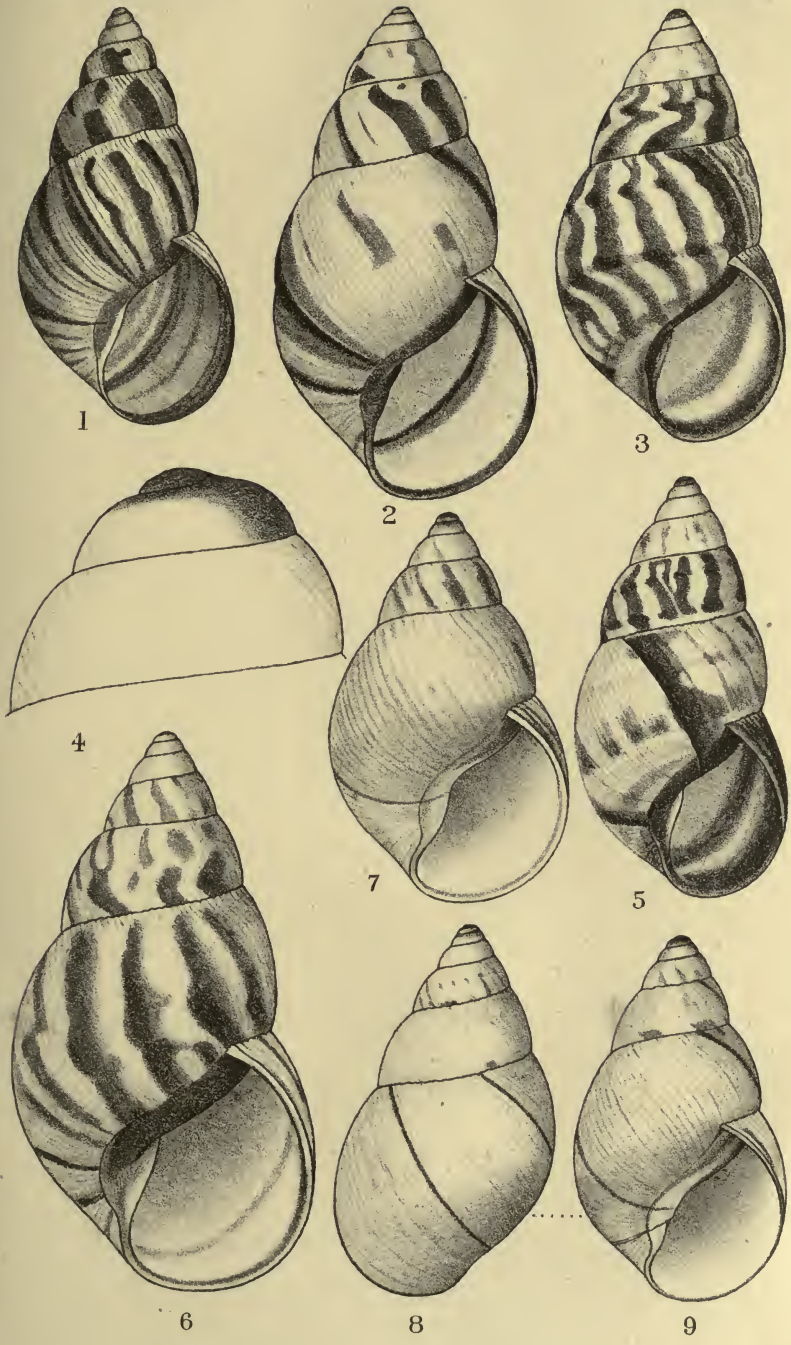
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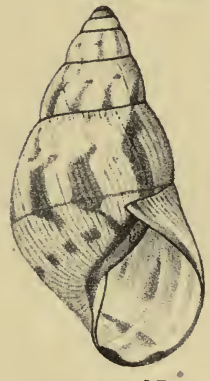

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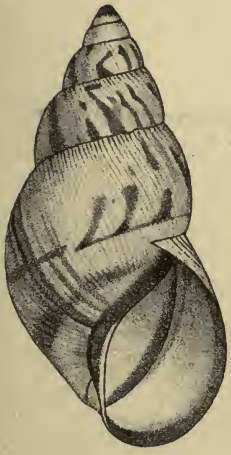

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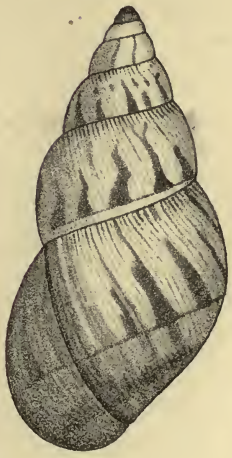

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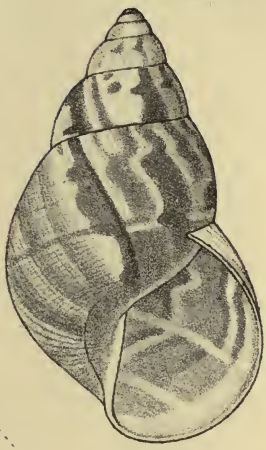

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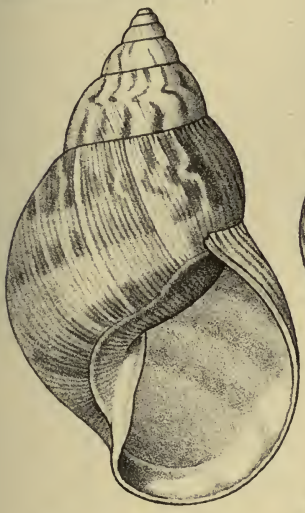

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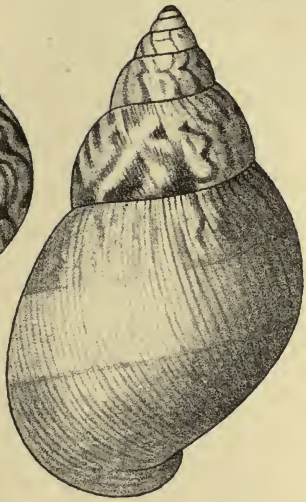

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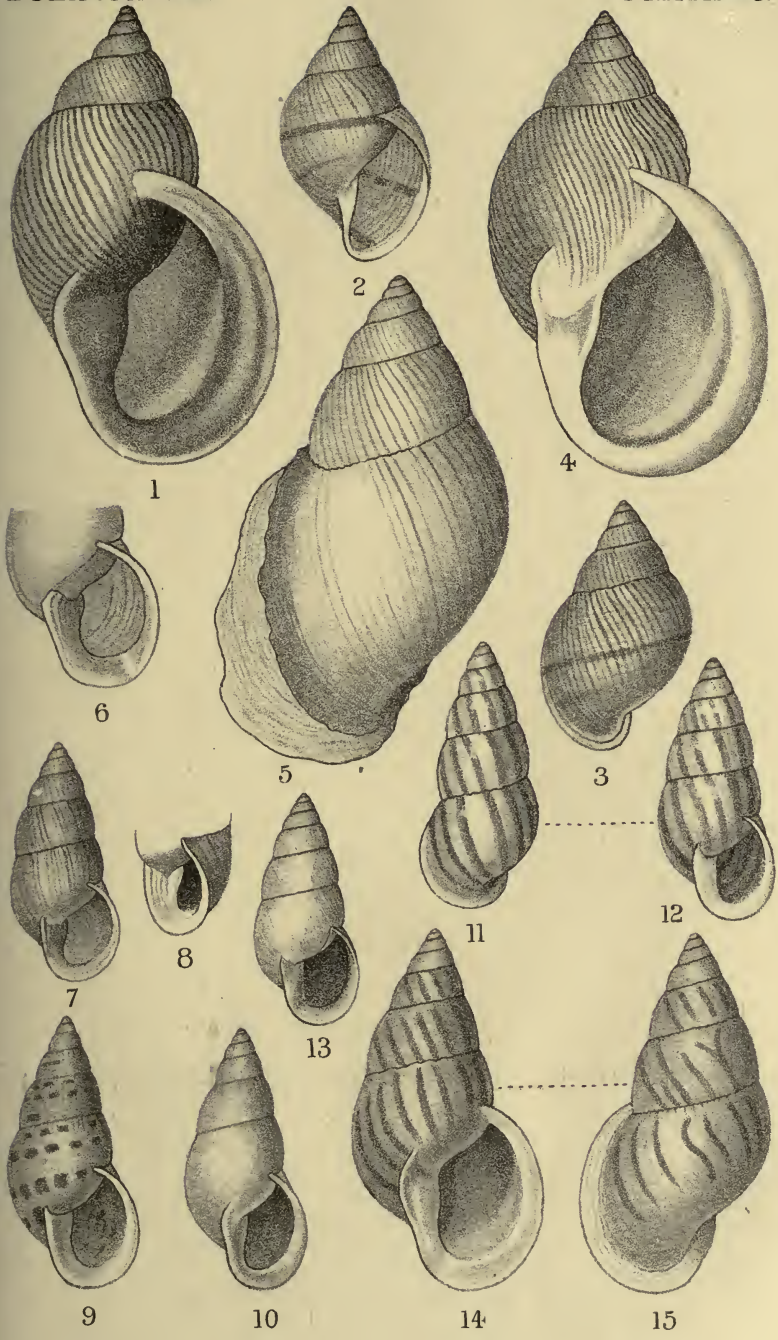
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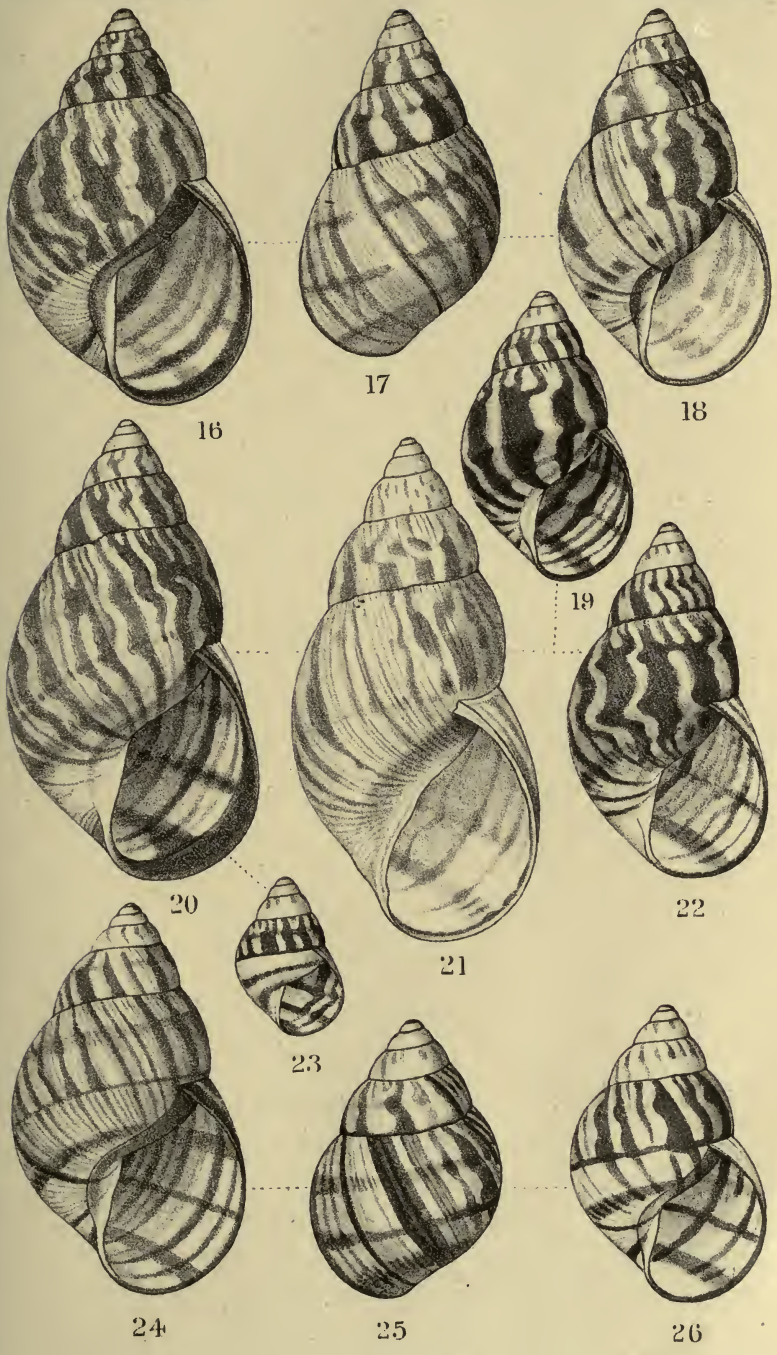
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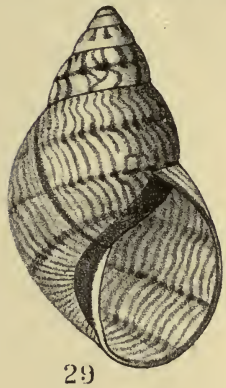

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*c*. Streaks straight, or reduced to spots, aperture rather short, oblique, *longa*, p. 126

$c^1$. Streaks straight or waved, generally rich blackish-brown, with tawny ones intermingled *boucardi*, p. 128

$c^2$. Streaks angulated or obsolete, two or three broken spiral bands developed. *uhdeana*, p. 129

$c^3$. Solid, plicatulate, conic, mainly white, the varices generally narrow, columella short, oblique, truncate below. *strebeli*, p. 128

O. PRINCEPS (Broderip). Pl. 16, all figures; pl. 17, figs. 10–12 (varieties).

Shell ovate-conic, rather wide, moderately solid; growth striæ inconspicuous. Nearly white or cream-tinted, with waved stripes which are dilated into *broad quadrate or irregular blotches along a super-peripheral belt, each forking into several branches along the sub-sutural zone*, and bi- or trifurcate below, a girdle of small blotches formed at angles in the stripes, encircling the middle of the base; dark varices few, rarely exceeding one or two on the whole shell. Whorls $6\frac{1}{2}$, convex, the apex obtuse, usually with a minute black tip.

Aperture ovate, quite oblique, white or showing angular streaks within; peristome not thickened, usually dark-edged; columella thin, white, straight or a little concave; parietal callus thin, dark brown.

Alt. 57, diam. 34, longest axis of aperture 31 mill.

Alt. 63, diam. 35, longest axis of aperture 33 mill.

Alt. 43, diam. 27, longest axis of aperture 25 mill.

Young (figs. 3, 4) with continuous or subcontinuous peripheral, circum-umbilical and intermediate bands, and broad stripes above, the earlier 3 whorls corneous, without markings.

W. Mexico: *Mazatlan* (Reigen, Forrer), *Presidio de Mazatlan* (Richardson); *Tepec* (Cooper); *Tres Marias Islands* (Forrer, Richardson); *Colima* (Rolle). E. Mexico: *Papantla* (Deppe); *Misantla* (Salas); *Rancho de la Lima* and *Rancho de Quilate*, both near Misantla (Doña Estefania); *Playa Vicente*, in dense oak-forest (Höge); *Coatepec*, above Jalapa (Strebel, form C); *Almolonga*, below Jalapa (Höge); *Mirador* (Strebel, form C); *Callejones de Malibran*, near Vera Cruz, living on trunks of trees and on fences (Strebel, form A); *Cordova* (Höge); *Atoyac*, near Cordova (H. H. Smith); *Vera Cruz* (Sallé, Heilprin exped.). S. W. Mexico: *Panistlahuaca* and *Ixtapa*,

both in Oaxaca (Boucard); *Cerro de Acatepec*, near Tuletepec in Oaxaca, on evergreen oaks (Shuttleworth). Yucatan: *Merida* (Strebel, form D); *Tabi*, south of Merida (F. D. Godman); *Shkolak, Tekanto, Ticul, between Sitilpech and Tunkas*, and at *Silam* (Heilprin exped.). N. Guatemala: *Cahabon* (Sarg); *Coban* (Conradt); *Senahu and Chacoj* (Champion), *Panzos* (Conradt), all in the Polochic valley. W. & S. W. Guatemala: *Western lowlands, at Retalhulen and San Francisco Miramar*, also *near Capetillo*, ascending to an elevation of 3,500 feet above the sea, generally on trees, especially the guava and "volador" (Stoll.); *El Reposo, below Retalhulen, Cerro Zunil, and at San Isidro* near Mazatenango (Champion); *San Agustin* (Bocourt, var B). Salvador: *Conchagua* (Cuming). Nicaragua (Levy, Janson): Woods of *Nicaragua*, in the hollows of trees (Cuming). N. W. Costa Rica: *Guanacaste*, at an elevation of 250 metres above the sea, in woods round the Bay of Salinas (Pittier, A. Alfaro). *Panama* (Cuming, Martinez).

*Bulinus princeps* (Broderip), Sowerby, Conch. Illustr., *Bulinus*, f. 18 (1833).—*Bulimus* (*Orthalicus*) *princeps* Beck, Index Moll., p. 59. —*Orthalicus princeps* Shuttl., Notitiæ Malac. i, p. 64, t. 3, f. 6, 7. —Pfr., Monogr. Helic. Vivent. iv, p. 589.—Mörch, in Malak. Blätt. vi, p. 112 (1859).—v. Mart, in Malak. Blätt. xii, p. 40 (1865).—Fisch. & Crosse, Miss. Scient. Mex., Mollusca i, p. 455, pl. 18, f. 2, and varieties f. 2 a, 2 b.—Strebel, Beitr. Mex. Land- und Süssw.-Conch. v, pp. 11–16 (forms A–D, not E, F), pl. 3, f. 1 *a–d;* pl. 4, f. 1–5, 7, 8, 10, pl. 8 (anatomy), pl. 9, f. 1–11, and pl. 11, f. 1, 3 (radula); pl. 10, f. 1, 4, 7–10, 12–14, 16, and pl. 11, f. 2 (jaw), 5 (embryonic shell).—Pilsbry, Proc. Acad. Nat. Sci., Phila., 1891, p. 317.—Hidalgo, Viaje al Pacifico, p. 136; Journ. de Conchyl., 1870, p. 64.—Cooper, Proc. Cal. Acad. (2), v, p. 166 (1895).—*Ortalichus princeps* von Martens, Biol. Centr. Amer., p. 182, pl. 10, f. 3–6, with var. *fischeri*, p. 183, pl. 10, f. 7.—*Bulimus undatus* (Brug.), Valenciennes, Recueil d' Observ. Zoöl. ii, p. 245, pl. 55, f. 1 *a*, *b* (1833).—*Bulimus zebra*, var. *δ*, Pfr., Monogr. Helic. Vivent. ii, p. 144.—*Bulimus zebra*, var., Reeve, Conch. Icon. v, *Bulimus*, pl. 15, f. 90.—*Bulimus zebra* (part), Binney, Terr. air-breath, Moll. N. A., pl. 54, two smaller middle figures.—*Orthalicus zebra* (Müll.), Carpenter, Cat. Mazatlan Shells, pp. 176, 177.—H. & A. Adams, Gen. Rec. Moll., pl. 75, f. 6 *a* (shell).—? Angas, P. L. S., 1879, p. 483.—?*Orthalicus undatus* Brug., Stearns, Proc. U. S. Nat. Mus.

xvii, 1894, p. 162.—Dall, N. A. Fauna no. 14, p. 11.—? Bland in Grayson, Proc. Bost. Soc. Nat. Hist. xiv. p. 303 (1872), specimens from Socorro I.—? Semper, Reisen im Archip. Phil., Landmoll., p. 248, pl. 15, f. 9 (genitalia).

The type locality is Conchagua, in the republic of Salvador. In its typical development, this species is distinguished by its rather broad, full form, and the series of wide, squarish or angulated, dark blotches above the periphery, branching upward and below (figs. 1, 5, 6). The surface is smooth to the eye, black varices are wanting or few—one or two on the whole shell—and spiral bands, conspicuous in the young, are lacking in adult shells, this being the main difference between *princeps* and *ferussaci*.

The most slender specimen I have seen is shown in pl. 16, fig. 5. The characteristic pattern of typical *princeps* passes by imperceptible degrees into that shown in fig. 8 of pl. 16, and fig. 10 of pl. 17, in which the blotches of the median third of the whorl are split, the surface of the last whorl divided into four subequal zones by three series of arrow-spots, or three belts of angulation of the stripes. It sometimes becomes difficult or impossible to separate such examples from *O. ferussaci*, which is merely a less developed or retarded race.

Bland referred specimens of an *Oxystyla*, collected on Socorro Island by Col. Grayson, to *Orthalicus undatus* Brug. Probably it is *O. princeps* which lives there.

Var. *trifracta* n. var. Pl. 17, figs. 10, 11.

Contour typical and sculpture well developed; ground-color pale above, becoming decidedly yellow on the last whorl, with numerous dusky stripes thrice broken by girdles of angle-spots, and partially obsolete below the lowest girdle; spire with broad stripes and two continuous or subcontinuous bands, one above the middle, the other above or at the suture. Apex with a dark dot.

Alt. 50, diam. 32, longest axis of aperture 30 mill.

Alt. 53, diam. 33, longest axis of aperture 30½ mill.

*Salvador* (Swift).

*?O. princeps* var. β, Fischer and Crosse, Miss. Scient. Mex., Moll., p. 455, pl. 18, f. 2 *b*.

Specimens submitted by Robert Swift to Shuttleworth were considered by him a new species allied to *obductus*, according to a MS. note on the label of the type.

Var. *crossei* Martens. Pl. 17, fig. 12.

Subelongate-conic, the whorls less convex, with numerous narrower stripes. Alt. 54, diam. 30, aperture 28 mill.

*Belize, British Honduras* (Bocourt, Parsons); *Costa Rica* (van Patten).

*O. princeps* var. γ Crosse & Fischer, Miss. Scient. Mex., Moll., p. 455, pl. 18, f. 2 *c*.—*O. zoniferus* var. *crossei* Martens, Biol. Centr. pp. 180, 186.

Fig. 8 of pl. 16 shows a specimen somewhat transitional between *princeps* and this variety.

Var. *fischeri* Martens. Pl. 16, fig. 9.

Tawny, with numerous slightly darker streaks which are but little undulated; apex with minute brown dot; peristome narrowly brown-edged, the parietal callus brown. Alt. 55, diam. 33, length of aperture 30 mill. (*Martens.*)

*El Reposa and San Isidro, near Mazatenango, western Guatemala* (Champion).

*Ortalichus princeps var. fischeri* Martens, Biol. Centr. Amer., pp. 180, 183, pl. 10, f. 7 (exclusive of synonymy).

Var deceptor, n. v. Pl. 24, figs. 19–25.

Form and size about as in *obductus; general color-tone paler*, the ground purplish, olivaceous-yellow or pale fawn, *mottled in indistinct pattern* with dusky purplish or pale olive-brown streaks and clouds, and with the *peripheral band* (*or three bands*) *developed as series of oblong blackish spots alternating with light buff spots.* Spire with *whitish ground, irregular, often sparse flames, and two brown bands*, one median, the other super-sutural. Varices few. *Sculpture of O. princeps. Columella long and straight.*

Alt. 67, diam. 40, longest axis of aperture 38½ mill.

Alt. 49, diam. 30, longest axis of aperture 28½ mill.

British Honduras: *Belize*, in the woods (Bocourt). N. Guatemala: *Coban* (Sarg). Central Guatemala: *San Gerónimo* (Champion) *Polvon, Nicaragua*, (MacNiel); *Panama* (Cuming); *Islands in the Bay of Panama* (MacNiel).

*Orthalicus obductus* Fischer & Crosse, Miss Scient. Mex., Mollusca, i, p. 456 (exclusive of South American references and localities).—Binney, Ann. Lyc. N. York, xi, 1874, p. 37, pl. 6, f. iii, and Ann. N. Y. Acad. Sci. iii, p. 128, pl. 12, f. B. (radula)—Strebel,

Beitr. Mex. Land- und Süssw.-Conch. v. p. 34, form A, 4, form B, C, pl. 3, f. 7b, 7c, 4a, b.—*Ortalichus obductus* v. MARTENS, Biol. Centr. Amer., pp. 181, 187 (exclusive of South American references and localities).

This is so like the Venezuelan *O. obducta* that it has deceived a number of excellent conchologists, as may be seen by the above references. Under the lens, one at once sees strong sculptural peculiarities, *deccptor* having a comparatively coarse pattern of spiral threads, very irregularly waved, and modified by fine malleation, over the entire surface of the last whorl; while in *obducta* the spirals are very much finer, usually obsolete or nearly so over a great part of the surface, and in place of the malleation, which is wanting, there are distinct wrinkles along the growth-lines. *O. princeps* var. *trifracta* is to some extent a transition form to true *princeps*.

It is further distinguished from *O. obducta* by the general color-tone and pattern of the last, and especially of the earlier whorls; a comparison of thirty specimens from numerous Central American and Venezuelan localities showing these features to be constantly different. The long, straight columella is like that of *O. obducta*.

Figures 19 and 23 of pl. 24 were drawn from specimens from Polvon, Nicaragua, the type locality. Fig. 24 is from Nicaragua. Fig. 20 is a very pale, partially albino specimen from Honduras. Figs. 21 and 22 represent a very aberrant shell, collected by Prof. Ralph Tate in Nicaragua, exact locality not known; on a white ground, it is blotched with purplish-black and has three interrupted bands of tawny brown. The long, straight columella causes me to refer it to *deceptor* rather than to *ferussaci*.

Another aberrant shell is shown in fig. 25. It is from Panama, and differs from all the preceding by its elongate spire with the whole first whorl black, the striping conspicuous throughout, columella strongly convex, and aperture small. The sculpture is typical. This may be called form *perlonga*. Alt. 50, diam. 27½, longest axis of aperture 25½ mill.

The following west Mexican forms, *elegans* and *colimensis*, are known only by brief differential diagnoses, insufficient to establish their specific distinction, though they may be valid species.

*O. elegans* (Rolle).

Shell very similar to *O. princeps*, but differing in the more slender

form ; columella scarcely twisted, nearly vertically descending. Alt. 62, diam. 28.5, alt. of aperture 28, width 14 mill. (*Rolle.*)

*Colima, Western Mexico.*

*Orthalicus elegans* ROLLE, Nachr. Bl. D. Malak. Ges. 1895, p. 131, no. 15.

"Closely allied to *O. princeps*, but evidently separable specifically." It has not been figured.

*O. colimensis* (Rolle).

Differs from *O. princeps* in the more solid shell and much more twisted columella. Alt. 58, diam. 30, alt. of aperture 28, diam. 15 mill. A form standing between *O. princeps* and *O. ferussaci*, of which unfortunately only specimens collected dead are before me; it appears to me specifically different. (*Rolle.*)

*Colima.*

*Orth.* (*colimensis n. sp.?*) ROLLE, t. c. p. 131, no. 18.

O. LIVENS (Shuttleworth). Pl. 23, fig. 15.

Shell elongate-acuminate-ovate, thin, striatulate, marked with close and very minute undulating spiral lines; dull buff, ornamented with brown, somewhat waved streaks, subinterrupted or obsolete below the periphery of the last whorl, which is narrowly and inconspicuously two-banded. Spire conic, livid above, apex intense purple-black. Whorls 6, a little convex, the last about as long as the spire; columella slender, thread-like, rather straightened. Aperture oblique, truncate-oval, white inside, and somewhat streaked; peristome unexpanded, bordered with intense chestnut-brown, the margins connected by a chestnut-brown callus. Alt. 48, diam. 22, longest axis of aperture 25 mill. (*Shutt.*)

*Mexico, probably near Vera Cruz* (Sandoz).

*Orthalicus livens* SHUTT., Notitiæ Malacologicæ i, p. 64, pl. 3, f. 8 (1856).—PFR., Monogr. Hel. Viv. iv, p. 589.—? FISCHER & CROSSE, Miss. Scient. Mex., Moll. i, p. 453, pl. 18, f. 6, 6*a*.—? *O. livens* BECK, Index, p. 59 (nude name).

The typical *O. livens* is still known solely by Shuttleworth's description and figure. He remarks that the apex varies from intense to pale purple-black, and the streaks are sometimes wider and darker colored. It is allied to *O. princeps*, but differs in the more slender form, the last whorl not ventricose, base narrower, and the color, pattern and thinness of the shell.

The above description, comparisons and figure, from Shuttleworth, contain all the definite information available on this species, the type of which is in Shuttleworth's collection in Berne. The name was adopted from Beck, who simply enumerates *O. livens* among the species without any reference or description, and consequently it had no standing before 1856. According to Mörch (Malak. Bl. xii, 39, 1865), Beck's type was a rather solid, very obsoletely keeled, white shell, like Férussac's pl. 115, fig. 2—possibly an albino form of *O. longa;* but this fact has only antiquarian interest. The forms referred to *livens* by Crosse & Fischer and Strebel seem to me different, and probably members of the *O. longa* mutation-series. See *O. longa* var. *uhdeana.*

O. FERUSSACI (von Martens). Pl. 17, figs. 13, 14, 15, 16, 17.

Shell ovate conic, rather solid, lightly striatulate, somewhat plicate at the sutures, sculptured with very fine and close undulating and frequently interrupted spiral lines; white, with rather close purple-brown streaks, generally simple and straight, rarely zigzagged or forking and narrow, a few spiral bands, sometimes obsolete. Spire conic, uniform white above, the apex with a minute brown spot, whorls 6, nearly flat, the last moderately swollen. Aperture rather oblique, half the length of the shell, oval, acute above, white inside and showing the streaks; columella straightened, thin, white; peristome unexpanded, acute, narrowly brown edged; parietal callus of a more or less intense brown. Alt. 65, diam. 33, length of aperture 31, width 17 mill. (*Martens.*)

S. W. Mexico: *Tehuantepec*, on a species of *Tabernæmontana*, belonging to the family Apocyneæ (type locality; Deppe). Yucatan: *Shkolak* (Heilprin). N. Guatemala: *Panzos*, in the Polochic valley (Conradt), *Vera Paz* (Stoll). Central Guatemala: *San Gerónimo* (Champion); *Zacapa*, on a species of *Cereus*, in the treeless region (Stoll). Nicaragua: *Acoyapa* (Belt). Costa Rica: *Guanacaste* (Pittier) *Salinas Bay* (A. Alfaro).

*Cochlea vesicaria fluviatilis exotica, &c.*, SEBA, Thesaurus, iii, pl. 39, f. 54, 55 (1761).—*Zebra mülleri* CHEMNITZ, Conch. Cab. ix, 2, p. 24, pl. 118, f. 1015, 1016 (1786).—*Helix undata* FÉRUSSAC, Hist. Nat. Moll. Terr. et Fluv. t. 115, f. 1, 4 (living animal); Tabl. Syst., p. 48, no. 337 (part).—*Bulimus undatus* (Brug.), PFR, in Martini & Chemnitz, Syst. Conch.-Cab., ed. 2, *Bulimus*, p. 7 (part) pl. 2, fig. 5 (copy from Chemnitz).—*Orthalicus ferussaci*, v. MART. in

Monatsber. Akad. Wiss. Berlin, 1863, p. 542; Malak. Blätt. xii, p. 42 (1865).—Pfr. Monogr. Helic. Vivent. vi, p. 199—Fisch. & Crosse, Miss. Scient. Mex., Mollusca, i, p. 447—Pilsbry, Proc. Acad. Nat. Sci., Phila. 1891, p. 317.—*Orthalicus princeps* Stoll, Guatem. Reisen, p. 430.—*Ortalichus ferussaci* Martens, Biol. Centr. Amer. p. 184, pl. 10, f. 8–10 (exclusive of South American localities and references).

Not *O. ferussaci* Martens, Binnenmoll. Venez., nor of Strebel, Beitr. Mex. Land- und Süsswasser-Conchylien, = *O. maracaibensis* Pfr.

"This species is chiefly characterized by *the combination of streaks and spiral bands.* Some specimens come very near to the young state of *O. princeps;* and others to *O. undata* Brug., from the Caribbean islands and Florida, which, however, is ordinarily more elliptically elongated, and has paler, rather bluish-livid, bands and streaks."

The description given above is that of Dr. von Martens, and figures 16 and 17 represent the typical specimens figured by him. Figs. 14, 15 are specimens from Salinas Bay, Costa Rica, where it occurs with *O. princeps.* Fig. 13 represents a shell from Shkolak, Yucatan.

In my opinion, the shells from Colombia and Venezuela referred to *ferussaci* by von Martens and Strebel are forms of *O. maracaibensis* Pfr., the large series before me practically demonstrating this position. In fact, *O. ferussaci* belongs to an appreciably different stock, that of *O. princeps;* agreeing with that species in the smoothness of the surface, rarity of black varices (not more than one or two on the whole shell, and those usually remote from the lip-edge), and in contour. It is sometimes a mere matter of opinion whether a given specimen be referred to *princeps* or to *ferussaci.* It is perhaps better as a sub-species of *princeps* than as a distinct species.

In its retention of spiral bands in the adult, *O. ferussaci* shows a more primitive condition of the color pattern than *O. princeps.*

Var. tricincta (von Martens). Pl. 18, figs. 4, 5, 6; pl. 17, fig. 18.

Form as in *ferussaci* or somewhat more slender, the aperture less than half the length of the shell; yellow or brownish below, paler above, with three brown spiral bands, the upper one often faint, almost wanting; longitudinal streaks typically wanting, but sometimes present though very faint; apex blackish; dark varices few or one, usually none on the latter half of the last whorl; peristome

brown-edged, parietal callus brown. Last whorl puckered a little below the suture.

Alt. 49, diam. 29, length of aperture 23–24 mill.

Alt. 43, diam. 25, length of aperture 20 mill.

*Nicaragua* (Lévy, Gabb). N. W. Costa Rica: *Quebrada* (ravine) *del Vijaqual*, in the valley of the Rio Saveyre, at an elevation of 150 metres (Pittier); *woods at Terraba*, at an elevation of 250 to 270 metres; *Alto de Mano Tigre*, 690 metres; *Boruca*, at an elevation of 450 metres; *El Pozo*, 50 metres, common in clear primeval woods (Pittier); *Costa Rica*, without nearer indication of locality (Carmiol, in Berlin Museum).

*Helix undata* Férussac, Hist. Nat. Moll. Terr. et Fluv., pl. 115, f. 3, 5 (living animal); Tabl. Syst., p. 48, no. 337 (part).—*Bulimus* (*Orthalicus*) *zebra* (Müll.) Beck, Index Moll., p. 59.—*Orthalicus zebra* (Müll.) Shuttl., Notitiæ Malac, p. 61, pl. 8, f. 3, 4.—Pfr., Monogr. Helic. Vivent. iv, p. 589.—H. & A. Adams, Gen. Moll., pl. 75, f. 6 (living animal, copied from Férussac).—*Orthalicus princeps* Mörch, in Malak. Blätt. vi, p. 112 (1859).—*Orthalicus melanocheilus* (Val.), Fisch. & Crosse, Miss. Scient. Mex., Mollusca i, p. 458 (in part), pl. 18, f. 5, 5*a*.—*Ortalichus tricinctus* Martens, Biol. Centr. Amer. pp. 180, 185, pl. 11, f. 8 (1893).

"This species has been confounded with the North Mexican *O. melanocheilus*, from which it differs in the more ovate and thinner shell, and the ordinarily well-defined three dark brown spiral bands." It is smoother than most specimens of the three-banded form of *O. maracaibensis*, with fewer black varices, and a shorter body-whorl and aperture. In *O. undata* var. *floridensis* the body-whorl and aperture are larger.

Typical *O. tricincta* might well be considered a distinct species were it not that among the specimens collected by Gabb in Nicaragua there is one (pl. 17, fig. 18) showing faintly but unmistakably the longitudinal flames of *O. ferussaci*, though with all the other features of the *tricincta* with which it was found associated. This causes me to consider *tricincta* an extreme form of *ferussaci*, which in another direction merges into *princeps*.

I have also before me two specimens labeled "Nicaragua," collected by Gabb, in one of which the three bands are faintly visible on close inspection, the other totally wanting them, being marked with dark varices only.

O. MELANOCHEILUS (Valenciennes). Pl. 18, figs. 1, 2, 3.

Shell rather elongate-conic, with lightly convex whorls; tawny-yellow, unicolored or rarely with one or two narrow spiral bands; last whorl with several narrow blackish varices; apex white. Aperture white inside, showing a black varix or two; peristome slightly thickened, with a rather wide black-brown border.

Alt. 60, diam. 34, aperture 28 mill.

Alt. 50, diam. 28, aperture 21 mill.

*N. W. Mexico: Tres Marias Islands* (Forrer, Richardson); *Mazatlan* (Reigen); *Sierra Madre* (? Tonalá in Jalisco) (Xantus); *Colima* (Rolle).

*Bulimus melanocheilus* VALENC. in Humboldt & Bonpland's Recueil d'Observ. Zool., ii, p. 246, pl. 55, f. 3 *a*, *b*. (1833).—*Orthalicus melanochilus* (Valenc.), v. MART. in Malak. Blätt. xii, pp. 45, 70 (1865).—BINNEY, Terr. Air-breath. Moll. U. S., v, p. 410, f. 287; Man. Amer. Land Shells, p. 440, f. 484.—ROLLE, Nachrbl. D. M. Ges. 1895, p. 130.—*Ortalichus melanochilus* v. MARTENS, Biol. Centr. Amer., Moll., pp. 181, 190, pl. 11, f. 6, 7, 7a (1893).—*Bulimus zebra* var. *e*. PFR., Monogr. Helic. Vivent. ii, p. 144.—*Orthalicus zebra* (Müll.), CARPENTER, Cat. Mazatlan Shells. pp. 176, 177.—BINNEY & BLAND, Land and Fresh-water Shells of N. America, i, 217, f. 371, p. 215, f. 367 (jaw).—*Orthalicus undatus* Brug., var. ? = *O. melanocheilus* Val., STEARNS, Proc. U. S. Nat. Mus. xvii, 1894, p. 163.

The more oblong body-whorl, obsolescence of the dark spiral bands, and numerous blackish varices are the main features separating this from *O. ferussaci* var. *tricincta*, which, moreover, seems to be widely separated in geographic range from what has been selected as true *melanocheilus* by Dr. von Martens.

It should be said, also, that the selection of the Northern Mexican form as the true *melanocheilus* is wholly arbitrary. The original specimen may have been either *O. ferussaci tricincta* or *O. maracaibensis imitator*. As to the original locality, "Valenciennes gives simply 'Nouvelle Espagne,' that is to say Mexico and Central America; his figure, although showing distinct bands, agrees better in its more elongated form with the N. W. Mexican species than with the Central American *O. ferussaci*, var. *tricinctus*."

It is not known from what striped form of *Orthalicus* the northwestern *melanocheilus* arose; but probably future collections will show

its genesis by bringing integrading forms to light; and it may then prove to be merely a form of some flammulate species, probably *princeps* or *ferussaci*, rather than an independent species.

O. ZONIFERA (Strebel). Pl. 23, figs. 10, 11, 12, 13, 14.

Shell ovate, moderately solid, smooth, with the usual microscopic sculpture, finely plicate or puckered at the sutures. Whitish, closely marked with numerous blackish-brown or bluish-brown streaks, some in harmony with the growth-lines, others sinuous, narrower and generally forked at the upper fourth of the last whorl, wider in the middle, and again narrower on the basal fourth; penultimate and next earlier whorls with broad patches, forked or narrow above, earliest $2\frac{1}{2}$ whorls yellowish-corneous with a minute blackish apical mark; black-brown varices narrow, widely separated, generally 2 to 4 on the whole shell, 1 to 3 on the last whorl. No trace of spiral bands on the last whorl, but the antepenultimate or next earlier whorl has one submedian band. Aperture ovate, streaked white and dark or mostly blue-white within, quite oblique; peristome with a narrow black-brown edge; parietal wall dark brown.

Alt. 60, diam. 35.5, length of aperture 33 mill.

Alt. 52.6, diam. 35, length of aperture 29.6 mill.

Alt. 50.1, diam. 30.8, length of aperture 27.1 mill.

Alt. 50, diam. 27, length of aperture 25.5 mill.

Alt. 44, diam. 28, length of aperture 25 mill.

*Rancho del Platanillo near Iguala* (Doña Estefania); *Chilpancingo and Venta de Zopilote* (H. H. Smith); *Monte Pelegrino*, north of Acapulco (Berendt), all in the state of Guerrero. *Colima*, typical (Rolle). *Oaxaca* (Höge).

*Orthalicus zoniferus* STREBEL, Beitr. Mex. Land- und Süsswasser-Conch. v, p. 28, pl. 1, f. 7*a*, 7*b*, pl. 3, f. 11 (shells), pl. 11, f. 7, 7*a*, 8, 9 (anatomy) (1882).—*Ortalichus zoniferus* VON MARTENS, Biol. Centr. Amer. p. 180, 186, pl. 10, f. 12, 13 (exclusive of var. *crossei*).

The main differential feature of this species is the distribution of color on the body-whorl, the upper fourth and a tract around the columella being paler and whiter, with narrower streaks than the broad intervening belt, upon which the ground is often yellowish or light brown, and the stripes wider and darker; the surface being thus divided between two pale polar zones and a broad darker equatorial zone. The whorls of the spire are broadly blotched, as in *O. prin-*

*ceps*, so that the young could scarcely be distinguished from that species.

Von Martens refers the var. *crossei* to this species; but, though it occupies an intermediate place, I consider it, from the material seen, and the geographic location, as decidedly nearer *O. princeps*.

*O. nobilis* (Rolle).

Differs from *O. zoniferus*, which is near it, in the flat whorls, scarcely impressed suture, black apex and lip, columella nearly vertical, margin vertical, only slightly arcuate below. Alt. 59, diam. 29, alt. of aperture 28, width 16 mill. Holds the same relation to *O. zoniferus* that *O. elegans* does to *O. princeps* (*Rolle*).

*Colima, western Mexico.*

*Orth. nobilis* Rolle, Nachrbl. D. Malak. Ges. 1895, p. 131, no. 16.

Completely typical *O. zonifera* also occurs at Colima, according to Rolle.

O. livida (von Martens). Pl. 19, figs. 18, 19.

Shell ovate-conic, rather solid, regularly striated, plicatulate at the sutures, decussated by very fine spiral lines; dull buff, painted with close, pale violaceous, nearly straight streaks and some brown-black varices. Spire conic, apex with a large purple-black spot, whorls 7, the upper rather flat, the last a little more swollen. Aperture oblique, hardly half the length of the shell, oval, acute above, milky-purple inside; columella moderately twisted, milk-white; peristome unexpanded, black-brown, the terminations joined by a broad black-brown callus. Alt. 79, diam. 43, longest axis of aperture 43 mill. (*Mart.*) Another specimen measures: 62, 36, 34 mill.

*W. Mexico: Mazatlan* (Melchers). *Central Mexico: Province of Michoacan, especially at the Volcan de Jorullo* (type locality; Uhde).

*Bulimus zebra* var., Menke, in Zeitschr. für Malak. vii, p. 163 (1850).—Pfr. in Martini & Chemnitz, Syst. Conch. Cab., ed. 2, *Bulimus*, p. 377, pl. 22, f. 12.—*Orthalicus lividus* v. Mart. in Monatsb. Akad. Wiss. Berlin, 1863, p. 542; Malak. Blätt. xii, p. 57 (1865).—Pfr. Monogr. Helic. Vivent. vi, p. 99.—Fisch. & Crosse, Miss. Scient. Mex., Mollusca i, p. 448.—Strebel, Beitr. Mex. Land- und Süssw.-Conch. v, pp. 29–31, pl. 1, f, 8, pl. 4, f. 6 (and 9?), pl. 11, f. 18.—*Ortalichus lividus* v. Martens, Biol. Centr. Amer. pp. 180, 186, pl. 10, f. 11, 11*a* (1893).

O. MACLURÆ (v. Martens). Pl. 21, figs. 40, 41, 42.

Shell ovate-conic, solid, delicately spirally striatulate, plicatulate, at the sutures; yellowish, painted with wide, nearly straight black-brown streaks. Whorls $6\frac{1}{2}$, a little convex, the upper three yellow, not streaked, apex generally brown; last whorl regularly ovate. Aperture a little less than half the length; peristome rather widely black-brown, a little thickened; columella white, parietal callus intense chestnut-brown. Alt. 52, diam. 29, aperture 27 mill.

*a.* Last whorl equally streaked, apex pale or minutely brown (fig. 40).

*b.* Last whorl with the streaks confluent, anteriorly subequally tawny, varices repeated, two spiral bands continued from the fourth to the first part of the last whorl; apex broadly brown-black; columella narrowly whitish (fig. 41).

*c.* Albinistic; streaks and callus very pale fulvous, apex and peristome white (fig. 42).

*N. W. Nicaragua: Cacao, in the Bay of Fonseca*, on trees of the yellow-wood, *Maclura aurantiaca*, family *Moreæ* (Capt. Joh. Schäffer).

*Ortalichus macluræ* v. MARTENS, Biol. Centr. Amer., Moll., pp. 181, 188, pl. 11, f. 1–3 (August, 1893).

" Owing to the kindness of Fr. Bocherding, Vegesack, Bremen, I have before me twenty-two specimens collected at the same locality, which cannot be separated specifically one from the other. The ground-color is very pale yellow, in worn specimens white; the streaks are broad, dark blackish-brown, the interstices between them mostly about equal in width to the streaks themselves; in the upper whorls, however, the interstices are often even broader, and in this respect young, somewhat bleached specimens very much resemble *O. boucardi;* in some adult specimens, on the contrary, the streaks are narrower and more numerous in the last whorl, these examples approaching *O. zoniferus.* In most specimens the streaks are not forked at their upper end; in some, however, a few streaks are forked, but in none is the forking so constant and conspicuous as it is in *O. princeps.* In a few examples, one, two, or three narrow dark spiral bands are present on the fourth and fifth whorls, the lowest of them in the suture. In some specimens the apex is of the same pale yellow as the three upper whorls; in others, it is to a very small extent dark brown; in others, again, nearly the whole first whorl is dark. The

coloration of the tip does not coincide with the more or less numerous streaks on the last whorl; but in the specimens with spiral bands the dark color of the tip is rather more extended. The sculpture usually consists of spiral striæ only; but in several specimens numerous malleated impressions are also visible, sometimes in rows descending towards the aperture. The dimensions given above are taken from a most typical example of middle size; the largest specimen measures 58, 30 and 29 millim., but it is one of those which approach *O. zoniferus*. The variety *b* shows a prevalent dark coloration of the tip, the last whorl, and the aperture, together with a spiral band which is constantly present in the first half of the last whorl. The var. *c* may be termed an albino specimen, the brown color being very pale in the callus of the aperture, and wanting altogether at the tip and on the external edge of the aperture. In short, these twenty-two specimens prove that it is very difficult, or rather impossible, to trace clear and precise specific distinctions in this genus." (*Martens.*)

O. LONGA (Pfeiffer). Pl. 21, figs. 33, 34; pl. 22, all figs.

Shell elongate-conic or ovate-conic, *rather thick and strong*, white, or yellowish on the last whorl, boldly marked with black-brown or purplish-black stripes which are usually straight on the body-whorl, irregularly flexuous on the spire, and are often narrowly bordered with rust-reddish; *varices prominent, broad, black*, often bordered behind by a blue-gray stripe, and usually 4 to 6 on the whole shell, 3 or 4 frequently being upon the last whorl. A narrow brown band sometimes appears just above the suture on the spire. Surface nearly lustreless, with rather coarse growth-wrinkles, and subobsolete, minute, irregular spiral striæ. Whorls $6\frac{1}{2}$ to 7, the earlier ones slightly, the last two strongly convex. Apex obtuse, white or black.

Aperture small in the typical form, *very oblique*, ovate, white with black or purple stripes at the positions of the varices within; peristome simple, *broadly black bordered* outside and within; columella short, concave, wholly black, or white-edged; parietal callus black-brown.

Alt. 56, diam. 30.4, alt. of aperture 26.1 mill. (Pfeiffer's type.)

Alt. 60, diam. 31, longest axis of aperture 32 mill.

Alt. 56, diam. $27\frac{1}{2}$, longest axis of aperture 28 mill.

Localities for forms referred to *O. longa* (the type locality of which is unknown): Central Mexico: *State of Michoacan, especially at*

*Ario* (Uhde); *Cuernavaca* in the State of Morelos (Boucard). S. Mexico: *State of Oaxaca* (Boucard).

Localities for forms referred to *O. boucardi*: S. W. Mexico: *Villa Alta* in Oaxaca, on the slope of the central elevated plateau towards the Rio San Juan, copiously (Höge); *Oaxaca* (Höge); *Mountains of Betaza*, 20 leagues from Oaxaca (Boucard); *Cerro Negro, Tehuantepec* (Sumichrast); *Tehuantepec* (Strebel, Richardson, Dr. J. H. Streets).

*Bulimus zebra* var. *β* PFR., Monogr. Helic. Vivent. ii, p. 144.—*Orthalicus longus* PFR. Malak. Blätt. xii, p. 39 (1865).—FISCH. & CROSSE, Miss. Scient. Mex., Mollusca i, p. 450, pl. 18, f. 4.—STREBEL, Beitr. Mex. Land- und Süssw.-Conch. v, p. 43, pl. 6, f. 1 *a*, *b*, *c*, *d*.—*Ortalichus longus* v. MARTENS, Biol. Centr. Amer., Moll., pp. 181, 189.

*Orthalicus boucardi* PFR., P. Z. S., 1860, p. 138, pl. 51, fig. 7; Malak. Blätt. viii, p. 16 (1861).—v. MART. Malak. Blätt. xii, p. 37 (1865).—PFR. Monogr. Helic. Vivent. vi, p. 200.—FISCH. & CROSSE, Miss. Scient. Mex., Mollusca i, p. 451, pl. 18, f. 3, 3 a, b.—STREBEL, Beitr. Mex. Land- und Süssw.-Conch. v, pp. 40, 41 (forms A B), pl. 1, f. 1 *a*, 2 *a–g* (form C) pl. 1, f. 1 *b*, *c*.—*Ortalichus boucardi* v. MARTENS, Biol. Centr. Amer., Moll., pp. 181, 187, pl. 11, f. 4, 5, 11.

The solidity of the shell, boldness of the dark and rather straight streaks on a white or in part rusty ground, and numerous broad varices, as well as the rather short aperture with broadly black-edged lip, distinguish this species when typically developed. It is, however, extraordinarily variable, and I am compelled to unite *O. boucardi* as one of its satellite forms.

In Pfeiffer's type of *longa* (pl. 21, fig. 34), which has been photographed and described by Strebel, the stripes are but little angulated but are mostly forked on the upper fourth of the last whorl, and are grayer there, giving the zone below the suture a paler tone, the suture being also bordered below with white. The color of the stripes is not so vivid as in *O. boucardi*, and especially on the last whorl becomes grayish; they are mostly chestnut-edged, or there are also handsome chestnut-brown growth-streaks besides the black variceal streaks. The nuclear point of the apex is brown, and on the third or third and fourth whorls a submedian band, though sometimes interrupted, is distinctly developed. There are no bands on the last whorl, and the longitudinal streaks continue to the base.

The specimens before me show several striking divergencies from the above. In one lot from the Isthmus of Tehuantepec the short, concave columella is black-brown throughout, the shell long and narrow. Some of them (pl. 22, fig. 2) are white, with widely separated grayish-purple streaks, extending neither to suture or base; some of the varices edged with rust-brown. In others (pl. 21, fig. 33) the streaks are somewhat better developed, with some bright chestnut ones intermingled, and considerable suffusion of chestnut on the latter part of the last whorl. Sometimes a narrow band appears just above the suture on some whorls of the spire. Suture white-bordered below. In all this lot the earlier 3 whorls are white, without dark apical spot. The specimen figured by Crosse and Fischer (pl. 22, fig. 1) is similar to the Tehuantepec shells, though rather more closely streaked, and with white columella.

Another series of three shells (pl. 22, fig. 6), also white at the apex, has wide, waved grayish-purple flames shading into reddish on one edge; the columella is light-edged and folded, and the surface shows rather strong and regular folds. The largest one is shown in the figure. Alt. 68, diam. 37, longest axis of aperture 34 mill.

Var. *strebeli* n. v. (pl. 22, figs. 7, 8, 9). Shell short, conic, solid, with sub-regular fold-like growth-wrinkles; white, with some brown flames or traces of them on the spire, sometimes a few narrow, straight ones on the body-whorl, and with several very narrow varices; apical one or two whorls dark; columella passing gradually into the parietal wall, and obliquely truncate at base, white or brown with white edge; parietal wall light or dark brown.

Alt. 47, diam. 30, longest axis of aperture 28½ mill.

Alt. 46, diam. 27½, longest axis of aperture 26 mill.

Var. *boucardi* (Pfeiffer). Pl. 20, figs. 20–26, 29.

The type of *O. boucardi* is represented by fig. 26 of plate 20. It is white with broad brown bands and black varices, the suture white-bordered below. Other forms, in which the white predominates, and the stripes are reduced, sometimes very widely separated, seldom bent in zigzag, and often shortened into mere spots, as in figs. 20, 21, 24, 25, are also referred to this variety. Another of its manifestations is the "form A" of Strebel, in which the stripes are very broad in the young and on the spires of adults (pl. 20, figs. 23, 29). On the whole, the bands are more vivid than in *O. longa*. The apex is generally white.

Var. (pl. 21, figs. 35, 36). This is the "*melanocheilus* form" of *O. boucardi*, reported by Strebel. Six specimens, part of them young, were collected by Sumichrast in the Cerro Negro near St. Efigenia, Tehuantepec, together with "form A" (pl. 20, f. 23, 29). They agree with *boucardi* except in wanting stripes. The separated varices are narrow, brown-black; two adult and two young examples show two bands weakly indicated on the last whorl.

Var. *uhdeana* von Martens. Pl. 23, figs. 16, 17, 18; pl. 22, figs. 3, 4, 5.

Dull buff, with close, wide, continuous zigzag streaks of purplish-chestnut, the last whorl interruptedly 2 or 3 banded; apex purple-black; whorls $6\frac{1}{2}$, but slightly convex; peristome broadly dark-bordered.

*Western Mexico: State of Michoacan* (Uhde).

*Orthalicus livens* v. Martens, Malak. Blätter xii, p. 38 (1865).—Pfr., Monogr. Hel. Viv. vi, p. 200 (note).—Fischer & Crosse, Miss. Scient. Mex., Moll., p. 453, pl. 18, f. 6, 6*a*.—Strebel, Beitr. Mex. Land- und Süsswasser-Conch. v, p. 32, pl. 11, f. 19.—*Orthalichus livens* var. *uhdeanus* v. Martens, Biol. Centr. Amer., p. 181, 189 (1893).—*Orthalicus undatus* (part), Tryon, Amer. Journ. Conch. iii, pl. 13, f. 3.

Resembling *O. longa* in the broad dark varices, small aperture and general form, this differs in the less convex whorls and spiral bands or angulated stripes. The two specimens illustrated on pl. 22, figs. 3, 4, 5, were collected by Gabb, marked simply "Mexico." Another individual of this lot was figured by Tryon as *O. undatus* (Am. Jour. Conch. iii, pl. 13, f. 3). Fig. 5 resembles Fischer & Crosse's figure of "*livens*," but on the back the penultimate whorl shows angulated stripes like those on the last whorl of fig. 3. The latter figure corresponds well with the Michoacan specimen collected by Uhde, described by von Martens and figured by Strebel.

O. leucochilus (Fischer & Crosse). Pl. 21, figs. 37, 38, 39.

Shell ovate-conic, rather solid, longitudinally and somewhat obliquely wrinkle-striate, but little shining; white, with ashen varices; spire conic, the apex rather obtuse, suture impressed. Whorls $6\frac{1}{4}$, a little convex, the first two smooth, glossy, white, the last whorl slightly descending, slightly longer than the spire, more strongly wrinkle-striated. Aperture oblong-oval, somewhat obliquely reced-

ing, white inside; peristome simple, white, the terminations joined by a thin callus of the same color; columellar margin dilated, appressed, basal and outer margins slightly thickened. Alt. 53, diam. 30, longest axis of the aperture 28 mill. (*C. & F.*)

*Orizaba, prov. Vera Cruz, Mexico* (Berendt).

*Orthalicus leucochilus* C. & F., Journ. de Conchyl. xvii, p. 423 (1869); Miss. Scient. Mex., Moll. p. 459, pl. 18, f. 7, 7a.

In the single specimen before me (fig. 38), from the original locality and collector, the second whorl is yellowish, and there are some very faint broad yellowish streaks behind the outer lip. It resembles *O. longa* var. *strebeli* in the coarse surface folds, but not in the shape of either spire or columella. There is one greenish-gray varix on the back of the last whorl, and another bluish one at the beginning of the penultimate whorl. It apparently belongs to the group of *O. longa*.

O. PONDEROSA (Strebel). Pl. 19, figs. 14, 15, 16, 17.

Shell thick, hardly shining, apparently without cuticle, embryonal whorls black shading into dark brown, often with a violaceous tinge. Ground-color dirty whitish, with a yellowish tint above, the last whorl more or less reddish brown. On the third whorl longitudinal brown stripes begin, rapidly becoming broad, angularly broken and forked above, sharply defined against the ground-color, but on the last whorl frequently losing in intensity and becoming of a grayish tint, and giving place to continuous streaks or entirely disappearing, so that only the ground-color and the narrow black-brown or dark brown varix-streaks remain, these being bordered behind by a brownish-gray or greenish-gray streak, and near the aperture often crowded. The earlier whorls usually show traces of one band and the last whorl of three indistinct ones. Peristome broadly bordered inside with black-brown, fading though brownish-purple to the white of the interior. Sculpture of more or less coarse flat folds, so that the shell appears irregularly, more or less coarsely striated; toward the suture, where the color is lighter, the folds are sharply developed. Spiral grooves weak, often mingled with coarser furrows, and weak malleation. Columella very strong, short, white, and vertical.

Alt. 64, diam. 39.6, aperture 33.6 mill., whorls 7.

Alt. 50.7, diam. 35.2, aperture 30.8 mill., whorls 6.

*Western Mexico: San Blas, State of Jalisco* (Wessel, in coll. Dun-

ker); *Tepic* (Richardson); *Culata, near Manzanillo, State of Colima* (Lloyd, June, 1889); *Colima* (Rolle); *Dos Arroyos, 25 miles N. E. of Acapulco, State of Guerrero*, at an elevation of 1000 feet above the sea (H. H. Smith). *S. W. Mexico: Tehuantepec* (Strebel).

*Orthalicus ponderosus* STREBEL, Beitr. Mex. Land- und Süssw.-Conch. v, pp. 35, 36, pl. 7, f. 1, 5, 8.—ROLLE, Nachrbl. D. M. Ges., 1895, p. 130.—*Orthalicus boucardi-ponderosus* STREBEL, ibid., p. 39, pl. 1, f. 4 *a, b* (corrected on p. 132 to *ponderosus-boucardi*).—*Orthalicus lividus-princeps* STREBEL, ibid., p. 31, pl. 1, f. 6.—*Ortalichus ponderosus* v. MARTENS, Biol. Centr. Amer., Moll., pp. 181, 190, pl. 11, f. 9, 10, 10*a*.

"Strebel did not know the exact locality of the specimens which he described; but the collection of Dunker and the materials placed in my hands by Messrs. Godman and Salvin show that this remarkable species belongs to the western coast of Mexico, where it is somewhat widely distributed. In the Berlin Museum there is a shell much resembling this species, received from Dr. H. Dohrn, and said to have been found at Juraty, on the Amazon river. A similar shell is also stated to have been found in Colombia, in the holes of trees, by Wallis (see Mousson, Malak. Blätt. 1869, p. 179).

The apex is generally dark chestnut-brown, but in some apparently fresh specimens it is pale. The broad black lip inside the aperture is to be seen in young specimens measuring 43 mill. in length. The aperture is all around of a shining black, only the columellar edge itself is pinkish-white, with the base of the aperture black, the white forming a more or less narrow streak on the columella. The general color of the shell is yellowish-brown; the dark streaks are more distinct on the upper whorls, confluent and often very indistinct on the last." (*Martens.*)

O. DECOLOR (Strebel). Pl. 54, figs. 43–47.

Shell ovate-conic, *thick and ponderous.* First whorl black, second and third yellowish or pink, small brown streaks appearing on the third whorl; on subsequent whorls of the spire the ground is whitish, with *broad dark-brown angular stripes*, usually forked above, and a super-median interrupted dark band. Stripes sometimes continue upon the first half of the last whorl, angulated at positions of the upper and peripheral bands, and terminating at an interrupted basal band; the latter half of the whorl *reddish- or orange-brown, longitudinally*

*clouded with lighter*, and with wide, ill-defined. *bluish or olive-green streaks behind the extremely narrow blackish varices;* entire last whorl sometimes without light flames or stripes. Varices narrow, two or three on the last whorl, one or two above it. Surface with fine, irregular spiral striæ and some shallow coarser furrows, somewhat, but finely, malleated; plicate below the sutures, and sometimes shallowly so on the body whorl generally. Whorls $6\frac{3}{4}$, slightly convex.

Aperture oblique, pure white or purple-tinted inside, often showing dark stripes at the positions of the varices; peristome obtuse, unexpanded, olivaceous-bordered outside, with a blackish border within, shading into violaceous. Parietal callus strong, black; columella heavy, vertical, straight, truncate or subtruncate at base, white or white-edged.

Alt. 67, diam. 38, longest axis of aperture 36 mill.

Alt. 63, diam. 37, longest axis of aperture $34\frac{1}{2}$ mill.

Alt. $57\frac{1}{2}$, diam. $31\frac{1}{2}$, longest axis of aperture 31 mill.

*Habitat unknown.*

*Orthalicus decolor* STREBEL, Beitr. Mex. Land- und Süsswasser-Conch. v, p. 37, pl. 7, f. 2, 3, 4 (1882).

One of Strebel's specimens was labeled "*Bulimus mars*, Costa Rica." Those in the collection of the Academy have borne the same specific name, with the localities "Ecuador" and "Brazil;" but I attach no weight whatever to these data. Similar to *O. mars* in general features, this species differs markedly in the straight, vertical columella, without a fold above. *O. ponderosa* I have not seen, and it is not unlikely that *decolor* may prove to be a form of that species. The differences do not seem to be great.

*South American Species.*

*A.* Longest axis of aperture exceeding half the length of the shell; columella concave or straight.

*b.* Ventricose, with pairs of yellow lines forming large zigzags; whorls $5\frac{1}{2}$; alt. 50–57 mill. *bifulgurata*, p. 143

*b*[1]. Ovate-conic, uniform whitish or with three bands, no longitudinal flames. *maracaibensis* form *imitator*, p. 140

*b*[2]. With longitudinal flames.

*c.* Large, alt. 56–68 mill., with inflated body-whorl; spire flamed, the last whorl brown with obscure or sub-obsolete flammulation, spiral bands inconspicu-

ous, the basal one usually obsolete; columella long and straight. *obductus*, p. 134

$c^1$. Smaller, regularly ovate-conic, the last whorl oval, flammulate, varices few, ground-color yellow or brownish, often with a light band below the periphery, parietal wall generally chestnut, alt. 44–51 mill.

*d*. *Stripes numerous, narrow* and regular; 3 bands. *pulchella*, p. 135

$d^1$. Stripes wide, irregular *pulchella* v. *prototypus*, p. 137

$c^2$. Ovate-conic, isabelline with pale blackish streaks and three narrow, interrupted brown bands; no dark parietal callus; alt. 49 mill.; Peru. *isabellina*, p. 142

$c^3$. Ovate- or oblong-conic, with the cuticle thin or wanting; white or pinkish, with narrow, straightish streaks and several varices; usually 3-banded (rarely with wide stripes). *maracaibensis*, p. 137

$c^4$. Similar, but obscurely angular at the periphery. *fulvescens*, p. 141

$A^1$. Longest axis of aperture less than half the length of the shell; columella with an oblique fold above; form stout; thick and solid, smoothish, the columella, parietal wall, and a wide internal lip-border blackish. *mars*, p. 143

$A^2$. Longest axis of aperture less than, or about equal to, half the length of the shell; columella convex in the middle or straight.

*b*. Strongly striated spirally, granulose. *bensoni*, p. 147

$b^1$. Spiral striæ slight or wanting.

*c*. Columella convex, black; irregularly streaked and spirally banded; diameter less than half the altitude; Bolivia. *phlogera*, p. 145

$c^1$. Columella pale-edged; diam. less than half the alt.

*d*. Alt. 70, diam. 30 mill.; spire with 2 or 3 articulated bands, wanting on last whorl; Peru. *macandrewi*, p. 147

$d^1$. Alt. 52, diam. 23 mill.; with narrow, nearly straight and close stripes throughout; no bands; Ecuador. *pfeifferi*, p. 146

$c^2$. Columella white-edged; diam. half the alt.; streaked and maculated; Venezuela. *varia*, p. 144

O. OBDUCTUS Shuttleworth. Pl. 25, figs. 31–36.

Shell large, ovate-conic, with large, rather inflated body-whorl, short, straightly conic spire, and obtuse apex; thin but moderately solid; surface rather lustreless, with moderate growth-wrinkles, subobsolete, delicate, waved microscopic spirals or none, and conspicuous folds below the suture; *yellowish-brown or reddish-brown, becoming whitish on the spire*, which is *conspicuously marked with brown stripes angulated and dilated near the middle* to form an interrupted girdle, the stripes becoming narrower and closer on the latter part of the penultimate whorl, *nearly or wholly obsolete on the last whorl*, which shows traces of two or three narrow girdles or none, and is more or less obscurely streaked obliquely, with some angulated white, and wider blackish stripes in places. Dark brown varices narrow, 1 to 4 in number, usually all on the last whorl. Antepenultimate or next earlier whorl often with a submedian band; apex with a comma-shaped spot, the following two or three whorls uniform yellowish or brownish.

Aperture large, ovate, milky with some dark markings inside; peristome narrowly brown-bordered; columella white, straight; parietal callus broad and dark brown.

Alt. 68, diam. 41, longest axis of aperture 39½ mill.

Alt. 56, diam. 32, longest axis of aperture 32 mill.

Venezuela: "*Barquimeseto*," probably *Barquisimeto*, *S. E. of Valencia* (from the late dealer Ed. Müller); on the borders of the *lake of Valencia* (Moritz); *Puerto Cabello* (Strebel, Swift); *Caracas* (Swift); *Western Venezuela, on the coast* (Blume). Ecuador: *Nabon*, 8000 feet above the sea (Wallis).

*Orthalicus obductus* SHUTTL., Notitiæ Malac. i, p. 61, pl. 3, f. 1–3 (1856).—PFR. Monogr. Helic. Vivent. iv, p. 587.—MOUSSON, in Malak Blätt. xvi, p. 179 (1869).—v. MART., Die Binnenmoll. Venez., p. 33 (189), pl. 2, f. 15 *a*, *b* (jaw and radula).—STREBEL, Beitr. Mex. Land- und Süsswasser-Conch., v, pp. 33, 34, form A, no. 1, 2, 3, 5, pl. 3, f. 7a (shell), pl. 12, f. 4, 5 (radula).—SEMPER, Reisen im Archip. Phil., p. 248, pl. 15, f. 8 (genitalia).—*Zebra obducta* MILLER, Malak. Bl. xxv, p. 186 (1878).—COUSIN, Fauna Malac. Rep. de l' Equateur, p. 43, in Bull. Soc. Zool. France xii, p.

199 (1887).—*O. zebra* H. & A. Adams, Gen. Rec. Moll. ii, p. 154, pl. 75, f. 6 a.

The full body-whorl, short, strictly conic spire, with the flamed upper, and brown clouded last whorl, are characteristics of this species, which is better defined than most of the *princeps* group. The variations in color-pattern are well shown on the plate.

Central American examples referred here by authors on that fauna, are distinct from the South American shell, and in fact not closely related. See under *O. princeps* var. *deceptor*.

Figures 31, 32 are copied from Shuttleworth's original illustrations. Figs. 35, 36 are specimens from Pto. Cabello, and fig. 34 represents an unusually boldly marked shell from Caracas, where the species does not attain so large a size as around Puerto Cabello.

The young of typical *obductus* (pl. 25, fig. 33) has, as Shuttleworth remarks, some resemblance to *O. pulchella*, showing numerous narrow parallel dusky stripes, bent or anastomosing at the positions of the three spot-bands, on a yellow ground. As a general rule, no varices are formed until near or at the end of the next-to-the-last whorl.

According to Semper, the penial accessory gland is so small and so united with the penis that it is hardly noticeable. This is quite different from the well-developed gland in *O. princeps*.

O. pulchella (Spix). Pl. 28, figs. 27–37.

Shell ovate-conic, rather thin but usually moderately solid, nearly smooth, the lines of growth hardly or not visible to the naked eye, with rather coarse, low, short folds below the suture, and fine, crowded superficial microscopic spiral lines. Surface lustreless, often with a velvety dullness. Variceal streaks narrow, brown, generally a single one developed, but sometimes none, or in some old shells a number appearing on the latter half of the last whorl. *Flesh-tinted under a thin light yellow cuticle*, marked with *narrow, crowded, equal, purple-brown longitudinal stripes*, about as wide as their intervals, *nearly straight, but bent a little below the sutures and at the positions of three girdles of small spots* or lunate and more or less confluent dilations of the stripes; the stripes becoming irregular and wider spaced and the upper (now median) band stronger, on the spire. Apex with terminal dark dot, obtuse. Whorls 6, moderately convex, the last oval. Aperture ovate, oblique, light flesh-tinted inside, and faintly showing

the external markings in lilac; peristome narrowly edged with chestnut; columella concave or nearly straight, white, thin; parietal callus rather thin, chestnut-colored, often in part wanting.

Alt. 44, diam. 26, longest axis of aperture 27 mill.

Alt. 51, diam. 30, longest axis of aperture 31 mill.

Eastern Brazil: *Province of Para* (Spix's type locality); *Pernambuco* (Moricand); *Bahia* (Blanchet, von Ihering, *et al.*). Southwestern Brazil: *Corumbá, prov. Matto Grosso* (H. H. Smith, Germain). *Dutch Guiana* or *Surinam* (Cuming coll.). Venezuela: *Barcelona* (C. Blume).

*Achatina pulchella* Spix, Testac. Brasilia pl. 9, f. 2 (legend at foot of plate) (1827).—*Bulimus pulchellus* Pfr., Monogr. ii, p. 144; iii, p. 389.—*Orthalicus pulchellus* Beck, Index Moll., p. 59.—Shuttleworth, Notitiæ Mal., i, p. 62, pl. 4, f. 6, 7.—Pfr., Monogr. iv, p. 588, vi, p. 199.—Ancey, Journ. of Conch. vii, p. 94.—*Bulimus undatus* Wagner, in Testac. Bras., p. 9.—*Helix undata* var. Fér., Hist., pl. 117, f. 1.—*Orthalicus zigzag* Beck, Index Moll., p. 59.—*??Bulimus zigzag* Lamarck, An. s. Vert. vi, 2d part, p. 118, no. 4 (1822); Edit. Deshayes viii, p. 223.

The typical form (pl. 28, figs. 27, 28, 29) appears at Para and Pernambuco; the variety at Bahia (figs. 36, 37) and in Venezuela (figs. 34, 35). In Surinam the shells are nearly typical in coloring, according to Shuttleworth's figures. I have not seen specimens from Matto Grosso, and do not know what form of the species occurs there. Figs. 30, 32, 33 are drawn from specimens labelled "Amazon River."

It is a beautiful species, very easy to recognize when typically developed (figs. 28, 29) by its crowded, narrow, dull purplish stripes, intersected by three narrow girdles, on a buff-fawn ground.

By coalescence of some of the stripes at the positions of the bands, triangular blotches separated by cream tinted intervals are sometimes developed (fig. 27).

The young (figs. 30–33) has less crowded, wider and more angulated stripes and continuous or subcontinuous girdles, assimilating to the ancestral type of the whole group. There is generally an almost white band below the peripheral girdle, and below the basal another, the latter bounded below by a circum-columellar dark band which does not occur in other species of the *Zebra* group, and is obsolete in adults of *pulchella*. The bands are dark brown within the mouth, the streaks a little lighter, and the white markings alluded to are very distinct.

Shuttleworth examined the radula and jaw, stating that the latter is composed of 22 segments.

Var. *prototypus* n. v. Pl. 28, figs. 32–37.

Stripes on the median portion of the last whorl having a tendency to become broad, irregular, interrupted; the girdles composed mainly of arrow-shaped or wedge-shaped rather large spots; markings blackish-purple.

*Bahia, Brazil; Barcelona, Venezuela.*

*O. pulchellus* var. β SHUTTLEWORTH, l. c.—*Helix undata* MORICAND, Mém. sur les coq. terr. et fluv. de Bahia, in Mém. Soc. Phys. et d' Hist. Nat. de Genève vii, p. 423.

This is an earlier, less differentiated form of the species, of which typical *pulchella* is an extreme and more local development. It is more widely distributed than the typical form, occupying the northwestern and southern peripheral portions of the range of the species.

Figs. 36, 37 represent Bahia specimens not quite mature. Figs. 34, 35 are drawn from Barcelona, Venezuela, examples. The young of this form sometimes lack the cream-white sub-peripheral and basal bands, or have them but faintly developed. The apex has a large dark spot; the subsutural puckering may be either strongly developed though short, or almost wholly wanting; and in the specimens before me there is a single dark varix or none. The parietal wall is only lightly washed with chestnut; the markings are not so dark as in Bahia specimens, and the ground-color is browner.

That the Venezuelan specimens approach certain form of *O. maracaibensis* Pfr., there can be no doubt; but there does not seem to be an actual intergradation. The general tone of color is much browner, not pinkish or white, and the young are differently marked.

Possibly Strebel's *O. princeps* form E, from the Amazon (Beitr. Mex. Land- und Süsswasser-Conch. v, p. 16, pl. 3, f. 5) is identical with this variety. It measures 40 to 50 mill. long, with $6\frac{3}{8}$ to 7 whorls. The largest specimen of *prototypus* before me is $45\frac{1}{2}$ mill. long, with $6\frac{1}{2}$ whorls.

O. MARACAIBENSIS (Pfeiffer). Pl. 29, figs. 40–46; pl. 30, figs. 49–57.

Shell of the usual ovate form, thin but moderately solid, irregularly wrinkle-striate and with very fine, shallow, partially obsolete spiral striæ; nearly lusterless; no noticeable cuticle. Typically white, of

a cold, faint flesh-tint on the last whorl, with three more or less noticeable spiral bands, the median one most persistent, narrow, and nearly continuous, the others wider, fainter, and often discontinuous or obsolete; longitudinally marked with light purple or bluish-brown undulating stripes, frequently mingled with narrower straight brownish ones in the direction of growth-striæ, or entirely without stripes; varices narrow and rather numerous, often three or four on the last whorl. Apex generally with a minute brown dot. Whorls 6 to 7.

Aperture ovate, purplish-flesh-tinted inside, showing the external markings; parietal callus thin, light chestnut, with paler streaks; peristome simple, narrowly dark edged.

Alt. 48, diam. 29, longest axis of aperture 29 mill.

Alt. 44, diam. 26, longest axis of aperture 26 mill.

Alt. 67.8, diam. 40, longest axis of aperture 36.4 mill.

*Venezuela: Maracaibo* (Gruner, C. F. Penny); *Barcelona* (C. Blume); *I. of Margarita* (Couthouy); *near the Lake of Valencia* (Moritz); *Caracas* (Lansberg); *Angostura*, on the Orinoco (Gruner). *Colombia: Region of the lower part of the R. Magdalena*, in holes in tree-trunks, not higher than six feet above the ground (Wallis); *Barranguilla* (Swift), *Santa Marta* (Grosskopf); *Rio de la Hacha* (Wessel, Swift); *Savana Grande at Santa Marta and Valley Cosai* (Sievers); *Sierra Nevada*, on the trunks of *Hecastophyllum dubium* (family Papilionaceæ), and at *Urumita* in the Cordillera de Los Andes (Sievers). *Ecuador: San Juan de la Costa* (Reiss). *Peru: Marañon R.* (Warschewitz).

*Typical form.*

*Orthalicus maracaibensis* Pfr., Malak. Blätt. iii, p. 186 (1856); Monogr. iv, p. 588.—Martens, Binnenmoll. Venezuela's p. 32, in Festschrift zur Feier des 100-jährigen Bestehens der Gesell. Naturforsch. Freunde zu Berlin, p. 188, pl. 1, f. 7 (1873).—Strebel, Beitr. Mex. Land- und Süsswasser-Conch. v, p. 27, pl. 3, f. 8 *a*, *b*, *c*. —*Orthalicus ferussaci* v. Martens, Binnenmoll. Venez., p. 32 (188), pl. 1, f. 6.—*Ortalichus ferussaci* v. Martens in part (all South American localities and references), Biologia Centrali-Americana, Moll., p. 184.—*Orthalicus ferussaci* forms A and C, Strebel, Beitr. Mex. Land- und Süsswasser-Conch. v. pp. 18–21, 23, 24, pl. 2, f. 4 *a*, *b*, 5 *a*, 6 *a–d*, 7, 9 *a*, *b*, 8 (shell), pl. 10, f. 2, 6, 17, pl. 12, f. 4, 5 (anatomy).—?*O. princeps* form E, Strebel, t. c., p. 16, pl. 3, f. 2,

5.—?*Bulimus undatus* Appun, Unter den Tropen i, p. 141.—?Troschel in Schomburgk's Reisen in Britisch-Guiana iii, p. 548.

*Three-banded form.*

*Orthalicus zebra* Shuttleworth, Notitiæ Malak. i, p. 61, pl. 8, f. 3, 4.—Pfr., Monogr. iv, p. 588.—Mousson in Malak. Blätt. xvi, 1869, p. 179.—*Orthalicus ferussaci* form B, Strebel, Beitr. Mex. und Süsswasser-Conch. v, p. 21, pl. 2, f. 1 *a–e*, 2 *a–d*, 3 *a*, *b* (shells), pl. 9, f. 12, 13, pl. 10, f. 3, 5, pl. 11, f. 6, 6 a (anatomy).—*Ortalichus tricinctus* v. Martens in part (all South American references and localities), Biologia, p. 185 (1893).—*Orthalicus melanochilus*, in part (all South American references and localities) Fischer and Crosse, Miss. Scient. Mex., Moll., p. 458.

The literature of this species has been almost inextricably confused with that relating to *O. ferussaci* and its form *tricincta*. The large series before me demonstrates the complete intergradation of the striped with the three-banded and bandless forms, and fully supports Strebel's contention that these are only extremes of a variable species, against Dr. von Martens' distribution of them between the two species *ferussaci* and *tricincta*.

Numerous specimens before me from Maracaibo and the neighboring island of Ioas agree with Pfeiffer's types, as described by him and redescribed and figured by Strebel (pl. 29, fig. 41, *type*, and figs. 40, 42 other specimens from Pfeiffer's collection). They are rather livid, faded-out shells, though in quite fresh condition. Sometimes there are no bands on the penultimate whorl, and in some cases there are rather broad markings on the spire, bifurcate above, somewhat as in *O. princeps*.

There also occurs at Maracaibo a form in which the stripes are broad and dark bluish-brown throughout, the surface less wrinkled and less interrupted by vicissitudes of growth (pl. 29, figs. 44, 45). Some of these approach *O. pulchella* var. *prototypus*, but they do not have the brown ground-color of that form, it being nearly white. A wholly similar form occurs at Barcelona.

Another Maracaibo specimen, pl. 29, fig. 46, somewhat simulates *O. pulchella*, having numerous thrice angulated flesh-colored stripes on a warm, pale, flesh-white ground.

On the island of Margarita an ill-defined form occurs (pl. 30, fig. 58) with very concave columella, narrow purple-brown stripes obso-

lete in places and on the base, on a dirty flesh-tinted ground, and no dark varices, though of rude, frequently arrested growth. The lip, parietal wall and apex are whitish.

From the Rio Hacha, a series of eight specimens is before me, some of which are figured, pl. 30, figs. 55, 56, 57. They vary from the typical coloring to more heavily-marked forms, and through specimens with fainter and fainter stripes, to a white form with no stripes, a chestnut basal band, and traces of a peripheral band. The intergradation is quite complete, and could be doubted by no one who saw the shells. All of them are smaller than Maracaibo specimens, an average one measuring, alt. 40, diam. 23, longest axis of aperture 22 mill.

Form *imitator* n. Pl. 30, figs. 49, 50, 51, 52, 53, 54.

From near Maracaibo we have a series of shells (pl. 30, figs. 49, 50, 51, 52) which vary from (1) slightly yellowish-white, absolutely bandless and with no stripes; varices none, or one narrow olive line; aperture white or yellowish inside, the apex, lip and parietal wall white, to (2) one to three banded with brown or purplish-brown on a white or flesh-tinted ground, varices, lip and parietal wall dark, apex dark or white, or (3) in addition to these markings, having extremely faint gray or brown longitudinal undulating stripes, apex white (fig. 50). Measurements are as follows:

Alt. 52, diam. 30½, longest axis of aperture 31 mill. (albino).

Alt. 51, diam. 30, longest axis of aperture 29 mill. (3-banded).

The young (pl. 30, fig. 52) look like *O. ferussaci tricincta*, but there is a fourth (circum-columellar) band well developed.

Exactly the same form occurs at Barranguilla (pl. 30, figs. 53, 54), the columella in these being either rather straight and stout, and the spire without markings, or the columella slighter and concave, spire conspicuously banded; varixed, and with a chestnut streak behind the varix.

Besides the localities mentioned above, this form has been collected at Santa Marta, in Colombia, by Grosskopf; on the Magdalena river, by Wallis, and in Ecuador at San Juan de la Costa, by Dr. Reiss. It occurs almost everywhere with the striped typical form of the species. Dr. von Martens reports it, under the name *tricincta*, from the Marañon river, Peru.

Var. SUBPULCHELLA n. v. Pl. 28, figs. 38, 39.

Small and rather thin, smooth, showing under the lens *fine, dense, irregular, wavy or anteriorly-descending spiral striation* with occasional slight malleation, exactly as in *O. princeps* and its allies. *White*, with rather close, fine markings of longitudinal undulating stripes, and three interrupted or subcontinuous spiral bands, the stripes generally split above the upper band, as in many specimens of *O. pulchella* var. *prototypus; varices narrow, black and conspicuous, generally 2 or 3 on the last whorl*, and one or more on the next earlier; *apex black.* Aperture conspicuously striped inside; peristome edged with blackish; parietal callus dark chestnut, rather thin; columella rather straight, and white. Whorls $5\frac{1}{2}$.

Alt. 34, diam. 20, longest axis of aperture $20\frac{1}{2}$ mill.

*Union Island, Grenadines* (C. D. Stewart).

Paler and more finely marked than the Trinidad *O. undata*, and differing conspicuously from all forms of that species in the fine sculpture. It lacks the yellow or brown cuticle of *O. pulchella* and its variety *prototypus.* It seems to lie on the debatable borderland between *undata, maracaibensis* and *pulchella.*

O. FULVESCENS (Pfeiffer). Pl. 29, figs. 47, 48.

Pfeiffer's type, as described by Strebel, is a thin though strong shell, with dirty Isabella tinted ground-color, becoming lighter toward the apex, darker below, the embryonal whorls with no brown dot; sometimes spiral bands appear, but usually only narrow brown-black varix-streaks, light bordered in front. Whorls $6\frac{3}{4}$. The peristome is narrowly dark-edged outside, the dark more broadly spreading inside; the parietal callus is chestnut-brown, and the interior of the aperture brownish-purple-white. The sculpture consists of inconspicuous longitudinal wrinkles, a slightly-developed plication at the suture, and fine, distinct spiral grooves. The white columella is sinuous and stands oblique to the axis of the shell. The last whorl is distinctly keeled at the periphery.

Alt. 51.1, diam. 29.9, aperture 25.3 mill. (type).

Alt. 42.3, diam. 24.8, aperture 22.2 mill. (Rio Hacha specimen).

*Rio Hacha, Colombia* (Strebel).

*Bulimus zebra* γ PFR., Monogr. Helic. Viv. ii, p. 144.—*B. zebra var.*, PFR., Conchyl. Cab. p. 377, pl. 22, f. 11.—*Orthalicus fulvescens* PFR., Malak. Blätter iii, p. 187 (1856); Monogr. iv, p. 590.—

Strebel, Beitr. Mex. Land- und Süsswasser-Conch. v, p. 42, pl. 6, f. 2 *a–c*.

The obtusely angulated periphery of the last whorl and distinct spiral striæ seem to distinguish this form from those varieties of *O. maracaibensis* which have a similar "griseo-fulvescens" color, narrow varices with clear light border, and three bands or none. The words "obsoletely clouded with bluish" of Pfeiffer's diagnosis should be deleted, as that appearance is due to the dried soft parts, according to Strebel.

A young specimen with the type in Dohrn's collection has three faint but distinct spiral bands. Strebel's specimens were received with shells from the Hacha river, and in all probability came from that place. The smaller one shows some faint longitudinal streaks on the third and fourth whorls, which pass into spots and then disappear farther on. The larger (fig. 48) shows a narrow peripheral band of light chestnut right above the suture on the fourth and fifth whorls, fading and changing to a whitish band on the last whorl; the upper band appears on the fourth whorl, is white, and continues, though indistinct, to the aperture. The white part of the bands is more transparent than the rest of the shell.

O. isabellina (von Martens). Pl. 31, fig. 66.

Shell ovate-conic, rather thin, very lightly striatulate, plicatulate at the suture, sculptured with very close, fine spiral lines; isabelline, with pale blackish streaks and three narrow brown bands, generally frequently interrupted, and with a few brownish varices. Spire conic, the apex brown or white; whorls nearly 6, a little convex, the last moderately swollen. Aperture rather oblique, a little exceeding half the shell's length, rhombic-oval, brownish and variegated with chestnut inside; columella straight, thin, white; peristome unexpanded, acute, isabelline or pale brownish; no parietal callus.

Alt. 49, diam. 23½, length of aperture 21½, width 13 mill. (*Mts.*)

*Peru, forests of the eastern slope of the inland cordillera* (Tschudi).

*Bulimus zebra* var. δ Troschel, Archiv für Naturgeschichte 1852, i, p. 195.—*Orthalicus isabellinus* von Martens, Binnenmoll. Venezuela's, in Festschrift Ges. Naturforsch. Freunde Berlin, p. 191, pl. 1, f. 8 (1873).—Pfr., Monogr. Hel. Viv. viii, p. 263.

Apparently belongs to the group of *O. ferussaci*. Dr. von Martens figures a smaller specimen than his measurements indicate as the size

attained by the species. It is distinguished from most of the closely allied forms of the *O. ferussaci* type by wanting a chestnut parietal callus.

O. BIFULGURATA (Reeve). Pl. 31, figs. 59, 60, 61.

Shell imperforate, ovate-conic, striate and minutely decussated with spiral lines; greenish-brown, elegantly decorated with pairs of yellow zigzag lines. Spire convex-conic, obtuse; whorls $5\frac{1}{2}$, a little convex, the last somewhat longer, inflated, somewhat tapering at base. Aperture a little oblique, oval-oblong; peristome simple, unexpanded; the columella rather straight, compressed, white, its margin a little reflexed and adnate.

Alt. 57, diam. 36, longest axis of aperture 33 mill.

Alt. 50, diam. 24, longest axis of aperture 28 mill.

*Andes of Colombia* (Reeve); *Pilaton Valley, Ecuador*, 1000 meters alt. (Wolf).

*Bulimus bifulguratus* REEVE, Conch. Icon., pl. 82, f. 606 (Dec., 1849).—PFR., Monogr. iii, p. 388.—HIGGINS, P. Z. S., 1872, p. 687. —*Orthalicus bifulguratus* SHUTTLEWORTH, Notitiæ Malacologicæ i, p. 60.—*Zebra bifulgurata* COUSIN, Bull. Soc. Zool. France xii, p. 198.—*Zebra fulgur* MILLER, Malak. Blätter xxv, p. 186 (1878), and (n. F.) i, p. 201 (as *Orthalicus fulgur*), pl. 6, f. 1 *a*, *b*. *Cf.* DOHRN, Jahrb. D. M. Ges. vii, p. 88.

The ventricose form and elegant coloration are characteristic. Fig. 61 is the synonymous *Z. fulgur* of Miller.

O. MARS (Pfeiffer). Pl. 53, fig. 42.

Shell imperforate, oblong-conic, solid, nearly smooth; flesh-colored, livid-clouded; spire conic, the apex obtuse; suture crenulated. Whorls 7, moderately convex, the middle marbled with grayish-white, the last whorl about two-fifths the length of the shell, wrinkle-striated anteriorly. Aperture oblique, oval, pearly white in the interior; peristome unexpanded, obtuse, black-bordered inside, the terminations connected by an entering black callus; columella black, callous, twisted and folded. Alt. 77, diam. 35, aperture 36 mill. long, 21 wide (*Pfr.*).

*Ecuador* (Cuming Coll.).

*Orthalicus mars* PFR., P. Z. S., 1861, p. 25, pl. 2, f. 8; Malak. Blätter 1861, p. 77; Monogr. vi, p. 202.—*Corona mars* COUSIN,

Bull. Soc. Zool. France xii, 1887, p. 193.—Miller, Malak. Bl. xxv, p. 185, 1878.

Known only by the description and figure given by Pfeiffer. The folded columella apparently separates this species from *O. ponderosa* and *O. decolor*, which are extremely similar in form and coloration. See pp. 130, 131.

O. varia (von Martens). Pl. 32, figs. 69–77.

Shell oblong-conic, rather thin but solid, the surface slightly glossy, with slight, fine growth-wrinkles but *no spiral striæ* or only faint striation in places; ground-color whitish, light yellow, light olivaceous-brown or pink, generally marked with several narrow interrupted blackish-brown or purple-brown girdles, and numerous narrow longitudinal stripes above the upper girdle, and often irregular streaks or blotches over the rest of the last whorl; usually several blackish varices on the last whorl, sometimes wanting or pale. Spire long, the apex obtuse, whitish. Whorls $6\frac{3}{4}$–7, convex.

Aperture small, *less than half as long as the shell*, somewhat oblique, whitish, variously marked within; peristome thin and acute, narrowly dark-edged; *columella convex, twisted*, its edge white, in old specimens calloused; parietal wall dark chestnut or blackish, rarely colorless.

Alt. 45, diam. $22\frac{1}{2}$, length of aperture 23 mill.

Alt. $42\frac{1}{2}$, diam. 23, length of aperture $22\frac{1}{2}$ mill.

Alt. 43, diam. $21\frac{1}{2}$, length of aperture $21\frac{1}{2}$ mill.

*Venezuela: Angostura* (Gruner, Blume); *Caracas* (Ernst, Sallé); *British Guiana: Demerara* (Cuming coll.)

*Bulimus phlogerus* Pfr., Monogr. ii, p. 145 (exclusive of synonymy); Conchyl. Cab., *Bulimus*, p. 196, pl. 47, f. 7, 8 (?).—*Orthalicus phlogerus* var. $\beta$ and $\gamma$, Shuttleworth, Notitiæ Malak. i, pp. 65, 89, pl. 4, f. 1, 2.—Semper, Reisen im Archip. Phil., Landmoll., p. 248, pl. 15, f. 2 (genitalia).—*Orthalicus varius* v. Martens, Binnenmoll. Venez., p. 34, in Festschr. Feier 100-jährigen Bestehens Ges. Naturforsch. Freunde zu Berlin, p. 190, pl. 1, f. 4a, 4b (1873). Pfr., Monogr. viii, p. 264.—*Achatina flogera* Potiez & Michaud, Galerie i, p. 127, pl. 12, f. 1, 2 (young shells).

Extremely variable in coloring, yet readily distinguished from all other species of the same region by its elongated form and small aperture. It is allied to *O. phlogera* and *O. bensoni*. The latter is

readily distinguished by its granulose surface, being scored by distinct spiral striæ cutting the growth-wrinkles into granules. *O. phlogera* is more allied in its smooth surface, but the black columella and details of coloration, the narrower mouth and more oblong last whorl, probably indicate specific distinction, in view of the widely separated habitats. The principal color-forms are:

1. Uniform flesh-pink, varices light brown, parietal callus transparent (fig. 74).

2. Yellow below, pink above, with a peripheral girdle of purple-brown spots, a narrow interrupted line above, and narrow streaks below the suture (fig. 75).

3. Brown or olive-brown, like the last or wanting the peripheral girdle (figs. 76, 77).

4. Variously and elaborately striped and streaked or blotched on a yellow or whitish ground (figs. 69, 70, 71).

Some specimens labelled "Brazil" are in the series of the Academy.

Semper found the accessory gland of the penis wanting in this species.

Drouet's *Bulimus zebra* (Moll. terr. et d'eau douce de la Guyane Française, p. 66, pl. 4, f. 48, 49) is evidently something of the nature of *O. varia* or *O. bensoni*, but I cannot reconcile his figures with either. Perhaps we have here to deal with another and still undefined species. It is from around Cayenne, the forest of Rouza, and Oyapoc, French Guiana. The "variété" figured does not look much like the "type."

O. PHLOGERA (Orbigny). Pl. 32, figs. 67, 68.

Shell elongated, quite thin, smooth; spire long, perceptibly swollen, the apex obtuse, black; composed of 7 slightly convex whorls; aperture oval, quite wide, the lip thin, acute; columella twisted, blackish, subtruncate in the young, rounded in adults. Colors: general tint whitish or purplish, paler on the last whorl; ornamented from place to place with large longitudinal brown stripes, especially on the last whorl; a wide band formed of dark purple-brown spots interrupted and flamed, appears around the middle of the last whorl and the upper portion of the others, bounded above and below by a blackish interrupted line; the other portion is marked with little longitudinal bands, equally spaced, of a purple-brown color; the summit is con-

stantly black-brown, and this dark shade colors the right margin of the lip and the whole columella. Alt. 55, diam. 24 mill.

*Around the Missions of San Xavier and Concepcion, Prov. Chiquitos, Bolivia* (Orb.).

*Helix phlogera* Orb., Mag. de Zool. 1835, p. 8.—*Bulimus phlogerus* Orb., Voy. dans l'Amér. Mérid. p. 257, pl. 29, f. 6, 7.—Pfr., Monogr. ii, p. 145 (part).—*Orthalicus phlogerus* Beck, Index, p. 59.—*Achatina phlogera* Pfr., Symbolæ ii, p. 134.

Orbigny's description, from which the above is taken, does not tally very well with his figures of this species. It is evidently allied to *O. bensoni* Rve., a larger and granulose species, occurring in a moister and more tropical region. The smaller size of *O. phlogera*, the less developed color-pattern on the last whorl as compared with *O. bensoni*, and the broad variceal streaks, are all attributable to the sparsely wooded and dry character of the region it inhabits.

O. pfeifferi (Hidalgo). Pl. 55, figs. 48, 49, 50.

Shell oblong-conic, rather solid, smooth, little shining; whitish-violaceous, very closely painted with longitudinal somewhat waved brown lines, and wide straight (variceal) streaks at irregular distances, each composed of a white and a brown streak; covered with an olivaceous cuticle. Spire long-conic, the apex tawny, rather obtuse; suture simple or lightly plicate. Whorls 7–8, nearly flat, widening at a moderate rate, the last not descending in front, slightly angular at its origin, somewhat tapering below.

Aperture oblong-semioval, three sevenths the length of the shell, dull white or brown inside; peristome simple, acute, broadly black-bordered inside, the margins joined by a blackish entering callus; columella a little twisted, rather straight, black, covered inside with a thick whitish callus. (*Hid.*)

Alt. 52, diam. 23 mill.

*Canelos, Ecuador* (Martinez).

*Orthalicus pfeifferi* Hid., Journ. de Conchyl., 1869, p. 41; Catal. Coq. Am. Merid., p. 39 (in Journ. de Conchyl., 1870), pl. 6, f. 8; Viaje al Pacifico, Moluscos, p. 135, pl. 8, f. 3, 4.—Pfr., Monogr. viii, p. 261.—*Zebra pfeifferi* Miller, Mal. Blätt. 1878, xxv, p. 186.

The longer spire, flatter whorls, structure of the columella and system of coloration, are the characters separating this species from *O. phlogera* Orb.

There are sixty longitudinal lines on the last, 51 on the penultimate whorl in the type specimen in the collection of Sr. Paz. In one in the Madrid Museum there is a whitish zone in the middle of the last whorl, interrupting most of the longitudinal stripes (fig. 50).

O. MACANDREWI (Sowerby). Pl. 41, fig. 5.

Shell elongated; grayish-fulvous, streaked and zoned with brown, here and there radiated with black. Apex a little obtuse, grayish-lilac. Whorls 8½, regularly increasing, a little convex, longitudinally lightly striated, separated by impressed sutures, spirally marked with three slightly conspicuous, brown and white articulated lines, vanishing on the whorls after the penultimate one; the last whorl about as long as the spire, roundly convex, with a grayish-fulvous zone above, brown ones at the middle and beneath; columella nearly straight, rather thin, grayish-lilac within, black outside. Aperture semioval, lilac within; peristome simple, hardly reflexed, slightly thickened, black-edged; columellar margin covered with a wide black callus spreading inward. Alt. 70, diam. 30 mill.; aperture 28 mill. long, 16 wide (*Sowerby*).

*San Diego de Cou, Peru.*

*Orthalicus MacAndrewi* SOWB., Journ. Linn. Soc. London xx, Zoölogy, p. 399, pl. 25, f. 18 (December 31, 1889).

"This species, of which I have seen only a single specimen, is similar in form to *O. bensoni*, but it has no spiral sculpture, and the coloring consists principally of light brown zones with a few longitudinal streaks of brown and black. The articulated painting is very slight, and is only to be seen on the upper whorls." (*Sowb.*)

O. BENSONI (Reeve). Pl. 31, figs. 62, 63, 64, 65.

Shell acuminate-oval, moderately solid, purplish or fleshy-white, usually covered with a greenish-yellow cuticle, and varied with *numerous narrow longitudinal purple-brown stripes* fading at their edges, *or fewer wide stripes*, and *encircled by three narrow girdles of purple-brown oblong or arrow-shaped spots alternating with shorter cream-white intervals*, the basal girdle less distinct, the median and upper ones ascending the spire; one variceal streak or none. Surface scarcely shining, with close and rather irregular wrinkles of growth, *decussated and rendered granose by fine, close, deeply-cut spiral striæ.* Spire long, a little contracted near the obtuse apex; whorls 7½ to 8,

the first one black-tipped, nearly planorboid, the earlier two or three smooth except for short low folds just above the suture, the following whorls moderately convex.

Aperture somewhat oblique, rather small, purple-tinted, white inside; peristome simple, broadly bordered with purple-brown inside and out, columella subvertical, rather long, slightly convex, or somewhat calloused, white or dark chestnut colored; parietal callus chestnut.

Alt. 62, diam. 30, longest axis of aperture 27½ mill. (specimen).

Alt. 85, diam. 40 mill. (Crosse).

*Banks of the Amazon* (Reeve); *Upper Amazon* (Orton); *Mission of Sarayacu, Peru* (Castelnau); *Napo, Ecuador* (Martinez).

*Bulimus* (*Orthalicus*) *adamsoni* (Gray), Beck, Index, p. 60 (1837). —*Helix* (*Cochlitoma*) *regina* var. β minor, Ferussac Tabl. p. 49; Histoire, pl. 119, f. 1, 2.—*Bulimus bensoni* Reeve, Conch. Icon. pl. 78, f. 571 (Sept., 1849).—Pfr., Monogr. iii, p. 388; viii, p. 261; Conchyl. Cab. p. 75, pl. 21, f. 1.—Hupe in Castelnau's Exped., p. 31.—*Orthalicus bensoni* Shuttleworth, Notitiæ Mal. p. 60, pl. 4, f. 3, 4, 5.—Chenu, Ill. Conch. i, p. 439, f. 3225.—Hidalgo, Journ. de Conchyl. 1870, p. 64; Viaje al Pacifico, Mol., p. 133, pl. 7, f. 13. —Crosse, Journ. de Conchyl. 1871, p. 318.—*Zebra bensoni* Miller, Malak. Blätter xxv, p. 186.—Cousin, Bull. Soc. Zool. France xii, p. 198.

The long spire with large, rather mammillar apex, the three articulated girdles, and the fine but strong decussation of the surface are characteristic. There is a single variceal purple-brown streak on the penultimate whorl of the specimen drawn in fig. 62; one of Shuttleworth's illustrations shows a similar stripe, and Férussac's shell has one. The pattern varies, some specimens having narrow, others wide stripes, and the greenish-yellow cuticle of some shells is largely wanting, or very thin and pale yellow below on other specimens, otherwise in good condition. The large specimen from Napo (length 80, not 85 mill.), commented on by Hidalgo (fig. 65) has "a callosity superimposed upon the columella, as in *O. regina*, and due without any doubt to advancing age." This group of *Oxystyla* certainly approaches *Corona* in the convex form of the columella.

This species was noticed first by Férussac, who considered it a small form of his *H. regina*, and figured it on the plate of that species. Beck, in 1837, gives the name "*O. adamsoni* (Gray) B." to

these figures, referring to Férussac's plate; and as a synonym he quotes "Achatina adamsonii Gray! Gray, Sp. Z. fasc. 2, f. 4, 5." No such species occurs in either the text or plates of our copy of Gray's "Spicilegia Zoölogica," which is evidently the work referred to; but in the Proceedings of the Zoölogical Society for 1833, Gray described a *Bulinus adamsonii*, which is a species of the subgenus *Metorthalicus*.

Fig. 64 represents Reeve's type.

It is a species of the Upper Amazon region, and the localities "Guiana" and "Pernambuco," cited by some authors, require confirmation. Férussac gives "Cayenne" as the locality.

## Genus PORPHYROBAPHE Shuttleworth, 1856.

*Porphyrobaphe* (in part) Shuttl., Notitiæ Malacol. i, pp. 69, 70 (for *adamsoni*, *iostoma*, *kelletii*, *latevittata*, *labeo*, *irrorata*).—Von Martens in Albers, Die Hel. edit. 2, p. 227, type *O. iostomus* Sow. (1860); and of many recent authors.—Borus, in part, of Mörch, Catal. Yoldi, 1852, p. 27, and of H. & A. Adams, Gen. Rec. Moll. ii, p. 148.

Shell imperforate, ovate-conic, solid, with about $2\frac{1}{2}$ *smooth apical whorls;* aperture ovate, rather large, with the lip reflexed, expanded, or merely blunt and somewhat thick.

Jaw, dentition, central nervous system and genitalia (of *P. iostoma*) similar to those of *Oxystyla*, except that the penis is shorter and the spermatheca is larger with shorter duct. The penis bears a lobed appendix as in *Oxystyla*.

Type, *B. iostoma* Sowb. Distribution, northwestern Peru, to Colombia.

The only difference of much importance between *Porphyrobaphe* and *Oxystyla* is in the peristome, which is thick and blunt or reflexed in the former, thin and acute in the latter group. This is hardly of itself sufficient ground for generic separation; but as the name has already come into general use, and the soft anatomy may, when more fully examined, show other differences, it is probably best to adopt the group as of generic value. It differs from *Orthalicus* proper and from *Metorthalicus* in the smooth, not pitted, embryonic shell.

### *Key to Species of Porphyrobaphe.*

[*P. integer* is not included in this table.]

*a*. Lip blunt, not expanded or reflexed, brown or white, the columella and parietal callus pale; profusely mottled, and with several pale bands; finely decussated. *dennisoni*, p. 158.

*a*[1]. Lip expanded or reflexed, at least below.

*b*. Parietal wall blackish brown; lip usually colored; spiral striation when present rather finer than the longitudinal wrinkling.

*c*. Lip and columella purple; surface ashen or brown, usually mottled or dappled. *iostoma*, p. 150.

*c*[1]. Lip and columella blackish; surface striped and black-varixed on a light ground. *saturnus*, p. 153.

*b*[1]. Parietal callus white or bluish; spiral striæ separated, irregularly cutting the surface wrinkles into long granules; spire rather attenuated above.

*c*. Base rounded.

*d*. Columella folded, lip yellow or pinkish, shell purplish brown with light spots, sometimes yellowish. *irroratus*, p. 155.

*d*[1]. Columella hardly folded; peristome and parietal callus white; yellow, with some brown streaks and spots. *grevillei*, p. 156.

*c*[1]. Base strongly carinated; lip brown or white, parietal callus white. *iris*, p. 157.

### Group of P. iostoma.

P. iostoma (Sowerby). Pl. 49, figs. 17, 18, 19, 20, 21, 22.

Shell ovate-conic, solid, varying from rather thin to thick. Color (1) pale brownish or pink tinted, almost uniform or faintly mottled with purplish flesh-tint, or (2) creamy or light brown copiously strewn with dark brown or purplish-brown oblong spots, the spire with ragged or zigzag brown streaks, or (3) rarely pure white; frequently marked with a few dark variceal streaks. Surface dull or somewhat glossy, with coarse, usually irregular growth-wrinkles, more or less strongly plicatulate below the sutures, sometimes with a projecting varix or two on the last whorl; a lens often showing close, fine, spiral striation on the spire, or in smoother, thin-lipped shells, finely striated spirally throughout. Apex obtuse, the earlier $2\frac{1}{2}$ whorls forming the smooth nepionic shell. Whorls $5\frac{1}{2}$ to 6, convex, the last well rounded.

Aperture ovate, white within (sometimes showing the external

spots), slightly oblique; peristome somewhat thickened, or very heavily thickened and built forward, of a rich purple color; columella with a moderate white fold above; parietal wall with a thick dark chestnut callus, sometimes purple-edged.

Alt. $2\frac{3}{8}$, diam. $1\frac{1}{4}$ inch (Sowerby).

Alt. 60, diam. 35 mill. (typical form).

Alt. 66, diam. 37 mill.
Alt. 54, diam. 31 mill. } var. *bilabratus*.

N.-W. Peru: *Lechugal*, near Tumbez (Stolzmann); Western Ecuador: Prov. del Oro, at *Chacras*, on the Rio Zarumilla (Wolf), *Santa Rosa* (Dohrn); Prov. Guayas at *Puna Island* (Martinez), *Guayaquil* (Fontaine, Paz and others), *Colonche* (Wolf); Prov. Manabi at *Portoviego* (Cousin), *Montechristi* (Lehmann), *Island of Plata* (Cuming, Wolf); Prov. Esmeraldas at *Esmeraldas* (Lehmann), a small form. Andean region in the *Pilaton Valley*, Prov. Pichincha, at 1000 meters alt. (Boetzkes), and *Macas* in the Amazonian drainage, Prov. Chimborazo (Martinez).

*Bulimus iostoma* Sowerby, Zoölogical Journal i, p. 58, pl. 5, f. 1 (1824).—Dunker, Jahrb. d. D. Malak. Ges. ix, 1882, p. 379.—*Pachyotis iostoma* Beck, Index Moll. p. 56 (1837).—*Bulimus yostomus* Villa, Dispositio Syst. p. 20.—*Bulimus iostomus* Pfr., Monogr. Hel. Viv. ii, p. 29; iii, 307; iv, 370; vi, 14; viii, 22; Conchyl. Cab. p. 190, pl. 56, f. 1, 2.—Hidalgo, Journ. de Conchyl., 1870, p. 44; Viaje al Pacifico, p. 60, pl. 5, f. 7, 8.—*Bulimus* (*Borus*) *iostoma* Albers, Die Hel., 1850, p. 142.—*Orthalicus* (*Porphyrobaphe*) *iostomus* Martens in Alb., Die Hel. (2), p. 227 (1860).—Reibisch, Sitzungsber. u. Abhandl. Nat. Ges. Isis, 1896, p. 58 (1897).—*Bulimus* (*Porphyrobaphe*) *iostomus* Sow., Lubomirski, P. Z. S., 1879, p. 721.—*Porphyrobaphe iostoma* Shuttleworth, Notitiæ Malak. i, p. 70 (1856).—Miller, Malak. Blätter xxv, p. 184 (1878).—Dohrn, Jahrb. d. D. Malak. Ges. ix, 1882, p. 110 (variation).—Kobelt, Illustr. Conchylienbuch, pl. 82, f. 12.—*Porphyrobaphe iostomus* Cousin, Bull. Soc. Zool. de France xii, 1887, p. 202.—*Conf.* Fischer, Exped. Scient. Mex., Moll. i, p. 433 (brief account of anatomy).—*Porphyrobaphe jostomus* Pætel, Catal., p. 99.

*Bulimus phasianella* Valenciennes in Humboldt & Bonpland's Rec. d' Obs. Zool. ii, p. 244, pl. 55, f. 4 (1833).—Deshayes in Fér., Histoire ii, p. 24, pl. 143, f. 1–3.—*Bulimus phasianellus* Desh. in Lam., Anim. s. Vert. viii, p. 259.—Reeve, Conch. Icon., pl. 15, f.

88 (1848).—Orbigny, Voy. dans l' Amér. Mérid., Moll., p. 295.—*Helix* (*Cochlostyla*) *phasianella* Fér., Tabl. System. p. 48, no. 336 (nude name).—Orb., Mag. de Zool., 1835, p. 7.

The well authenticated range of this species extends from extreme N.-W. Peru, and the neighborhood of the bay of Guayaquil, to Esmeraldas in N.-W. Ecuador, including the island of Plata. It thus inhabits both the arid coast region and the moister tract of low mountains and coast, chiefly of tertiary or later age, though also ascending the Pilaton valley to 1000 meters above the sea. There is no evidence of its occurrence in Chili, the old citations being either erroneous or based upon former temporary political boundaries. With one exception, all of the localities are in the Pacific drainage, Macas being the sole place east of the main chain of the Andes whence it has been reported.

Cuming found it clinging to trees on the island of Plata, and in such profusion that they looked as if laden with fruit. This is confirmed by Dr. Wolf. Others have reported it from inside hollow logs, gregarious and in copious numbers. In consequence, the shell is abundant in collections, though a sufficient account of the anatomy is still to be supplied.

Sowerby's original account, and all of the published figures, pertain to the form with only moderately thickened lip and spirally striated last whorl. The spirals are sometimes very close, regular, and though minute, still strong, especially on the heavily mottled shells. The color varies from creamy brownish, paler above, to brown and copiously mottled; and there is often a pale band a little way below the suture.

Nine specimens in the series before me differ in having the spiral striation obsolete on the last whorl, and the lip and columellar margin greatly thickened and built forward beyond the reflection (pl. 50, figs. 26, 27). This form may be called var. *bilabratus*. It is lustreless, without conspicuous spots.

Var. *bilabratus* attains a larger size than the typical form, one collected by Dr. Wolf measuring 82 mill. long. The tendency to form a second or third expanded lip, leaving the former peristomes projecting as varices, is more usual than in thinner shells.

Hidalgo, Dohrn and Reibisch have discussed the variations of *P. iostoma*, but only the latter author notices the oblong, thick-lipped form. Dohrn has called attention to the relationship existing between

*iostoma* and *saturnus*, Both have strongly defined varices indicating periodical growth and rest periods, and in both the color and sculpture usually change a little at each varix. *P. saturnus* shows more clearly than *iostoma* the close relationship to *Oxystyla* in its coloration of waved stripes.

The young of *P. iostoma* (pl. 49, fig. 18) are exactly like *Oxystyla* in form, the columella being slender and straight, the outer lip thin, and the apex, of course, smooth.

The jaw and teeth are similar to those of the Mexican "Orthalicus," according to Fischer.

P. INTEGER (Pfeiffer). *Unfigured.*

Shell imperforate, solid, obliquely irregularly rugulate, spirally sulcate (the interstices closely arcuate-lineolate), flesh colored, painted with gray-brown streaks and flammules. Spire elongated-conic, rather obtuse; suture crenulated. Whorls $7\frac{1}{2}$, a little convex, the last a little shorter than the spire; columella grayish-lilac, cylindrical, somewhat twisted, arcuately passing into the peristome.

Aperture nearly vertical, truncate-oval; peristome somewhat thickened, narrowly expanded, the columellar margin subdilated, adnate. Alt. 82, diam. 39; aperture, alt. 40, width 22 mill. (*Pfr.*).

*Province of Quito, Ecuador* (Ida Pfeiffer).

*Bulimus integer* PFR., P. Z. S. 1855, p. 114; Monogr. iv. p. 369; vi, 13.—*Bulimus* (*Dryptus*) *integer* MARTENS in Albers, Die Hel. Edit. 2, p. 194.

*Variety:* Shell generally unicolored fleshy-gray; whorls $6\frac{1}{2}$, columella more twisted. Alt. 65, diam. 31; aperture alt. 34, width 17 mill. (*Pfr.*)

An unfigured shell, the systematic position of which is not certain. Miller (Malak Blätter xxv, 184) thinks *integer* specifically identical with *P. iostoma*, but I would hardly agree with this opinion, judging from the description alone.

P. SATURNUS (Pfeiffer). Pl. 50, figs. 23, 24, 25.

Shell ovate-conic or oblong-conic, solid. *Pale lilac under a thin yellowish olive cuticle*, usually in part lost, or remaining in spiral hair-lines, the spire with three earlier whorls uniform yellowish-corneous, the next whorl with a series of brown spots below the suture, *penultimate and next earlier whorls with numerous waved brown stripes on a yellowish ground*, these stripes sometimes continuing on the last whorl,

sometimes almost obsolete there; *three or four broad blackish varices* appearing on the penultimate and last whorls. Surface slightly glossy, with rather strong, fold-like striæ on the spire, the last whorl smoother, with a plicate band below the suture, and decussated with irregular spiral grooves. Whorls 6, the earlier $2\frac{1}{2}$ smooth, forming the nepionic shell; last whorl convex, sometimes ridged at the varices; apex obtuse.

Aperture somewhat oblique, ovate, pure white within; *peristome black*, thick, somewhat reflexed; columella slightly folded, nearly straight, mainly black; a black parietal callus deeply entering the aperture.

Alt. 70, diam. 38, longest axis of aperture 39 mill.

*Pallatanga Ecuador* (Fraser).

*Bulimus saturanus* (error for *saturnus*) PFR., P. Z. S. 1860, p. 136. —*B. satuanus* (error for *saturnus*) PFR., P. Z. S. 1860, Mollusca, pl. 51, f. 6.—*Bulimus saturnus* PFR., Malak. Blätter, viii, 1861, p. 11; Monogr. vi, p. 14.—*Porphyrobaphe saturnus* DOHRN, Jahrb. D. M. Ges. ix, 1882, p. 111.

I have below reproduced Pfeiffer's description because his type (fig. 25) was much more copiously striped than any of the specimens I have seen. The "lilac-flesh" ground color is concealed in good specimens by a thin yellowish-olive cuticle, which is easily rubbed off, and remains chiefly in the grooves of the spiral and growth striæ, usually as fine spiral capillary lines. The varices are black and conspicuous, usually three in number, one being on the penultimate, the others on the last whorl. The columella becomes bluish-white towards its insertion. There is considerable variation in size, the smallest specimens I have seen being about 60 mill. long, while Dohrn mentions one measuring alt. 82, diam. 33, length of aperture 41 mill.

Pfeiffer's original description is as follows:

Shell imperforate, somewhat fusiform oblong, solid; of a lilac-flesh tint flamed with brown. Spire conic, the apex rather acute, white. Whorls $6\frac{1}{2}$, the upper smooth, the rest obliquely striated, last whorl smoother, having several wide blackish varices, a little shorter than the spire, tapering at the base. Columella thick, twisted, black.

Aperture subvertical, acuminate, oblong; peristome black, narrowly reflexed, the margins joined by a black callus.

Alt. 76, diam. 33, aperture including peristome 38 mill. long.

### Group of P. irroratus.

P. irroratus (Reeve). Pl. 52, figs. 33–37.

Shell imperforate, conic-ovate, solid; spirally sulcate and closely striated longitudinally, but little shining. Greenish-fulvous, with irregularly-scattered fulvous and chestnut spots [or "reddish-purple, last whorl covered with a pale ash epidermis, sprinkled with brown-shaded fulvous white spots."] Spire conic, attenuated below the obtuse, reddish-corneous apex. Whorls 6, a little convex, more strongly plicate below the sutures, the last whorl ventricose, longer than the spire, with rounded base.

Aperture slightly oblique, oval, blue within; peristome expanded, thickened and reflexed, orange-colored or roseate [or buff], the margins joined by a thick, white or orange callus, right margin regularly arcuate; columella somewhat folded above, white or reddish, the columellar margin reflexed and adnate (*Pfr.*).

Alt. 64, diam. 38, longest axis of aperture 40½ mill. (specimen).

Alt. 77, diam. 39, longest axis of aperture 43 mill. (Reeve's fig).

*Ecuador: La Mocha and Guaranda* (Paz); *Macas* (Martinez); *Nanegal* (Martinez, Orton, Wolf, Stübel); *Pilaton Valley* (Boetzkes, var. *elongata* and *minor*); *Los Puentes*, near Gualea (Cousin, var. *elongata*); *Quito* (Cuming coll.); *Valle del Pastaza*, *near Mapoto* (Wolf).

*Bulimus irroratus* Reeve, Proc. Zool. Soc. Lond., 1849, p. 16, pl. 2, f. 10; Conch. Icon., pl. 62, f. 427 (March, 1849).—Deshayes in Fér. Hist. ii, p. 50, pl. 130, f. 5, 6.—Pfr., Monogr. iii, p. 304.—Hidalgo, Journ. de Conchyl., 1870, p. 44; Viaje al Pacifico, p. 59, pl. 6, f. 1.—Crosse, Journ. de Conchyl., 1871, p. 316.—*Porphyrobaphe* (?) *irrorata* Shuttl., Notitiæ Malac. i, p. 72.—Cousin, Bull. Soc. Zoöl. de France xii, 1887, p. 203 (p. 17 of separate copies).—*Dryptus irroratus* Miller, Malak. Blätter xxv, p. 179; (n. F.) i, pl. 5, f. 2a (var. *elongata*), 2b (var. *minor*).—*Orthalicus* (*Porphyrobaphe*) *irroratus* Rve., Martens, Conchol. Mittheil. p. 159.—Reibisch, Sitzungsber. u. Abhandl. Nat. Ges. Isis, 1896, p. 58 (1897).—*Orthalicus irroratus* Rv., Schacko, t. c., p. 197 (dentition).

"One of the most abundant and wide-spread species of Ecuador, showing great variations. The peristome is sometimes yellow, sometimes more or less rose-colored, in some specimens thin and weakly reflexed, in others strongly thickened. The commonest form is ven-

tricose, 69–75 mill. long, 35–37 in diameter, the last whorl being longer than the spire." (*Miller.*)

"Among the examples from Nanegal great variation occurs, as well in form as in coloration. The following measurements of three shells illustrates the former:

"Alt. 78, diam. 45, length of aperture 46, width including peristome 29

"Alt. 69, diam. 35, length of aperture 40, width including peristome 25.

"Alt. 70, diam. 39½, length of aperture 41, width including peristome 28.

"In respect to coloring, the peristome is sometimes yellow, sometimes rose-red; the ground-color of the shell is sometimes uniform yellowish, sometimes dark clouded, the upper whorls either yellowish-brown or dark violet-brown or white.

"A variety from the valley of the Rio Cinto at Pichincha, 1300 meters alt., is quite unicolored, with stronger parietal callus, but no nodule in the upper angle of the mouth." (*Martens.*)

The jaw, according to Schacko, is similar to that of *Orthalicus obductus*, composed of 17 plates, the median one triangular. The teeth are of the form usual in the *O. undatus* group, except that the laterals are more massive, closely crowded and quadrangular.

Miller describes two varieties:

Var. ELONGATA Mill. (pl. 52, fig. 33). Last whorl hardly as long as the spire; peristome very strongly thickened and broadly reflexed. Whorls 6½, alt. 75, diam. 30, aperture 35 mill. long, 17 wide inside.

*Pilaton Valley* (Boetzkes); *Los Puentes*, near Gualea, in abundance (Cousin).

Var. MINOR Mill. (pl. 52, fig. 35). Whorls 6; alt. 58, diam. 26, aperture 28 mill. long inside, 14 wide.

*Pilaton Valley.*

P. GREVILLEI ("Sowerby" Pfeiffer). Pl. 53, figs. 38, 39, 40, 41.

Shell ovate-acuminate, moderately solid. *Yellow, with occasional* (variceal) *brown streaks, and numerous irregularly scattered brown spots sometimes shadowed on the side toward the lip with paler yellow.* Surface slightly shining, *coarsely plicatulate*, puckered beneath the sutures, and *decussated by wide-spaced spiral lines*, cutting the surface-wrinkles into long granules. Spire rather slender, the lateral

outlines somewhat concave. Whorls 5½ to 6, convex, the earlier three smooth, uniform yellowish or flesh-colored, last whorl well rounded throughout.

Aperture but slightly oblique, ovate; white and showing some purplish mottling within; peristome pure white, reflexed and recurved, widest below, having a slight or decided tubercle on its face at the insertion above, outward from which there is a slight sinus; *columella concave*, hardly folded, white, narrow in the middle; parietal callus white, thin inside, thickened into a low nodule or ridge near the posterior angle of the mouth.

Alt. 60, diam. 35, longest axis of aperture 36½ mill.

Alt. 67, diam. 44 mill. (Pfeiffer's type).

*Quito, Ecuador* (Cuming).

*Bulimus grevillei* Sowerby, Pfr., Novit. Conch. iv, p. 143, pl. 133, f. 4, 5 (1876); Monogr. viii, p. 15 (1877).—*Dryptus grevillei* Sow., Miller, Malak. Blätter, xxv, 1878, p. 180.

This species is closely allied to *P. irroratus*, differing therefrom chiefly in the light coloration, less folded columella and wider basal lip. The tubercle at the insertion of the outer lip (see fig. 39) is not constant, being very low in a specimen before me received from Cuming. Perhaps the shallow sinus or bay in the lip near the insertion, may prove more constant; but it is not unlikely that *grevillei* may prove to be a variety of the older and variable *irroratus*.

*P. grevillei* differs from *P. iris* and *P. wallisianus* in being rounded beneath, not keeled.

The locality "Quito" rests upon the authority of Cumingian labels only. Wolf, Boetzkes, Stübel, Cousin, Paz and other collectors in Ecuador do not seem to have encountered the species.

P. iris (Pfeiffer). Pl. 51, figs. 28, 29, 30, 31, 32.

Shell ovate-acuminate, moderately solid and strong. White under a bright yellow or tawny-brown streaked cuticle, paler or white on the spire and basal keel. Surface slightly shining, *coarsely, irregularly plicate or plicatulate, decussated by rather wide-spaced spiral furrows* or lines, cutting the folds into spiral bands of oblong granules. Whorls 5½, the first 2¼ forming the nearly smooth, obtuse nepionic shell, the next whorl rather flattened, penultimate and last whorls convex, the latter having a *prominently exserted, blunt keel on the base.*

Aperture irregularly ovate, slightly oblique, white within; peri-

stome blunt, white or flesh-colored, expanded, becoming subreflexed below; columella vertical, straight or convex, white; parietal callus white.

Alt. 73, diam. 39, longest axis of aperture 43 mill.

Alt. 62, diam. 39, longest axis of aperture 39 mill.

*Colombia: La Ceja, Rio Negro* (type locality) and *mountains near Fresno, between Salamina and Santa Ana* (Bld.).

*Bulimus iris* Pfr., P. Z. S. 1852, p. 136; Conchyl. Cab. p. 244, pl. 65, f. 4, 5; Monogr. iii, p. 313; iv, 376; vi, 22.—Dohrn, Jahrb. d. D. Malak. Ges. ii, 1875, p. 298.—*Bulimus wallisianus* Mousson, Malak. Blätter xxi, 1873, p. 9.—Pfr., Novit. Conch. iv, p. 135, pl. 130, f. 7, 8; Monogr. viii, pp. 15, 604.—*Bulimus* (*Borus*) *fris* H. & A. Ad., Gen. Rec. Moll. ii, p. 148.—*Porphyrobaphe iris* Pfr., von Martens, Conchol. Mittheil., p. 174, pl. 35, f. 3 (apex).

Similar to *P. irroratus* and *grevillei* in sculpture, but distinguished by its basal keel. Dohrn has already discussed this species at some length, the specimens I have seen supporting his opinion of the extraordinarily wide swing of variation among individuals.

Pfeiffer's original specimen was rather small, length 64 mill., with the keel very near the columella, and the base, therefore, only slightly distorted (figs. 28, 29). Mousson's *wallisianus* (figs. 31, 32) was based upon a more strongly keeled shell, with very convex body-whorl and brown-streaked coloring. The type measured 62 mill. long; one before me agrees exactly in color, form and size, see second line of measurements above. A more aberrant, but in no way pathologic individual, is shown in fig. 30.

Dohrn gives the following extremes of size:

Alt. 87, diam. 41, length of aperture 48 mill.; thick and calcareous.

Alt. 52–59, diam. 26–27, length of aperture 32–34 mill.; thin, translucent.

### Group of P. dennisoni.

P. dennisoni (Reeve). Pl. 48, figs. 13, 14, 15, 16.

Shell imperforate, ovate-acuminate, rather thin, subgranulated by light growth striæ and somewhat undulating close spiral striæ, but little shining. Dull greenish buff, encircled with some pale bands, marked with sparse blackish streaks and strewn with purple-brown spots. Spire conic, the apex whitish, rather obtuse; suture impressed;

whorls 6, the upper ones flattened, streaked with brown, the penultimate more convex, last whorl about as long as the spire, rounded at base. Columella simple, rather straightened, white.

Aperture slightly oblique, oval, livid, with a pearly luster inside; peristome brown-edged, unexpanded, somewhat duplicate, not reflexed. (*Pfr.*)

Alt. 83, diam. 43 mill. (from fig. of type).

*Colombia: Marmato* among ferns, moss and dead leaves, in damp places (Bland); *Canea* (Da Costa); *Bogota* (Wallis).

*Bulimus dennisoni* Reeve, Conch. Icon., pl. 26, f. 166 (July, 1848). —Pfr., Conchyl. Cab., p. 245, pl. 66, f. 1, 2; Monogr. iii, p. 380.—Bland, in Adams' Contrib. to Conch., No. 11, p. 229.

*Orthalicus* (*Sultana*) *dennisoni* Shuttleworth, Notitiæ Malac. i, p. 58 (1856).—Pfr., Monogr. iv, 586; vi, 198.—*Cf.* Proc. Malac. Soc. Lond. i, p. 290, and Strebel, Beitr. Mex. Land- und Süsswasser-Conchyl. v, pp. 1, 2 (1882).

*Porphyrobaphe dennisoni* Mousson, Malak. Blätter xxi, 1873, p. 13, with var. *obscurata*, p. 14.—*Bulimus dennisoni* var. *obscurata* Mouss., Pfr., Novit. Conch. iv, p. 120, pl. 127, f. 12, 13.

The nepionic shell is composed of two and a half smooth corneous-buff whorls; the next whorl has a subsutural band of squarish brown spots. Specimens collected by Bland at Marmato are small, alt. 57, diam. 34½, longest axis of aperture 36½ mill., with 5½ whorls, closely and conspicuously decussated surface and brown lip; the columella is not straight, as in Reeve's figure, but markedly concave. This form may be called var. *marmatensis* (pl. 48, fig. 14). Another specimen measures 59, 34, 36½ mill.; it has a tubercle at the upper insertion of the outer lip, as figured for *P. grevillei*. I think it pathologic.

Pfeiffer figures a small specimen of the typical form, measuring alt. 71, diam. 35 mill.

Mousson describes a variety from Bogota: var. *obscurata* (pl. 48, fig. 13). A little smaller, alt. 71, diam. 37 mill., with elegant pattern of black-brown lines and diffuse spots upon white bands, the lip unexpanded and obtuse, grayish like the interior, not colored with brown. It is darker and more copiously and elaborately figured than the typical form.

The inclusion of *dennisoni* among the species with "zierlich punktförmigen Grübchen" upon the nuclear whorls, by Mousson, caused

some uneasiness to Strebel; but Mousson evidently did not actually see any such sculpture, but merely inferred it. The nepionic shell is smooth.

(?) B. VICTOR Pfeiffer. See vol. x, p. 82. I have not seen this species, but following Pfeiffer, placed it in *Eurytus*. Cousin has referred it to *Porphyrobaphe* (Bull. Soc. Zoöl. France xii, p. 204), and states that he procured it in Ecuador, precise locality not given.

PORPHYROBAPHE PEELII Miller, Mal. Blätt. xxv, 184 = *Drymæus peelii*, vol. xi, p. 205.

## Genus LIGUUS Montfort (*s. lat.*).

*Liguus* Montf. + *Corona* Alb. + *Hemibulimus* Martens.

Shell oblong- or ovate-conic, with simple, thin-edged, unexpanded lip, and obtuse, vertically wrinkled or smooth nepionic whorls, the columella usually truncated at its base, though sometimes continuous with the basal lip, and either concave, folded, or straight above.

The present group differs from *Orthalicus* in the sculpture of the nepionic whorls; from *Oxystyla* in the more lengthened general form, usual though not invariable truncation of the columella, and the vertical wrinkles of the nepionic shell, or the last nepionic whorl; a character frequently lost in old shells by wear, but probably invariable in the young.

The genus as limited above, is nearly coincident in distribution with the Helicoid genus *Pleurodonte*, inhabiting the two largest West Indian islands and the northern and north-western parts of South America. And as *Pleurodonte* is represented in South America by two peculiar sections, *Labyrinthus* and *Isomeria*, so *Liguus* appears on the continent in forms (*Corona* and *Hemibulimus*) differing from the Antillean.

The subgenera of *Liguus* may be arranged thus:

*Liguus* (in the narrow sense): Antillean forms with white or bright colored shell, rather small apex, and strictly arboreal habits.

*Hemibulimus:* Colombian forms with the shell dark, somber colored, the columella concave above, truncated below; habits probably terrestrial.

*Corona:* South American forms with the shell strong, apex obtuse as if cut off, the columella with a callous fold above, colors not vivid.

Subgenus LIGUUS Montfort, 1810.

*Liguus* MONTFORT, Conchyliologie Systématique ii, p. 422 (1810), Sole species *L. virgineus.*

*Chersina* (Humphrey, in part, Museum Calonnianum, p. 62, 1797) BECK, Index Moll., p. 74 (1837).

*Pseudotrochus* (Klein, in part, Tent. Meth. p. 26, 1753) MÖRCH, Catal. Yoldi, p. 21 (1852); Journ. de Conchyl. 1865, p. 390 (for *virginea* L.).—H. & A. ADAMS, Gen. Rec. Moll. ii, p. 135 (exclusive of several species of *Perideris*).

*Oxystrombus* (of Klein, in part, Tentamen Methodi Ostracologicæ, p. 32, 1753) MÖRCH, Catal. Yoldi, p. 21 (1852); Journ. de Conchyl. 1865, p. 270 (for *fasciatus* Müll.).

*Orthalicinus* FISCHER & CROSSE, Miss. Scient. Mex., Moll. i, p. 436 (1875), type *L. fasciatus.*

Shell imperforate, oblong-conic, either thin or solid, the nepionic shell not differentiated from the subsequent whorls, smooth, or with a few spiral bands of vertical wrinkles; the later whorls smooth, dull or glossy, white or vividly banded or streaked, pink, green and yellow often entering into the color-scheme; the cuticle, when present, very thin and inconspicuous; aperture rather small, ovate, the outer lip acute and unexpanded, columella vertical, and varying from heavy and abruptly truncated at the base (as in *Achatina*) to thin and continuous with the basal lip; always simple above.

Jaw as in *Oxystyla*, *Orthalicus*, etc. Radula with the cusps either all obtuse and rounded, or several in the median part longer and pointed. The penis has a lobed accessory gland or appendix, as in other genera of the sub-family.

Type *Bulla virginea* L. Distribution: Haiti, Cuba, with the Isle of Pines, Cozumel Island, Southern Florida and the keys. Arboreal.

The shell is generally less ventricose than in *Oxystyla*, not spirally striated, and usually lighter or brighter colored. *Corona* is more obtuse and less brilliantly colored, but is doubtless very closely allied to *Liguus.* It agrees in the slight wrinkles of the last nepionic whorl, cut into long granules, and the usually truncated columella; though in both groups, this is a variable character.

Of the names quoted as generic synonyms above, *Chersina* originally appeared in the anonymous sale-catalogue of M. de Calonne's collection, and covered many diverse genera; its resurrection and restriction by Beck in 1837 was long after Montfort had established

*Liguus.* *Pseudotrochus* and *Oxystrombus* of Klein would have no standing in binomial nomenclature even if they had been natural groups, which they were not; and Mörch's use of the names in 1852 was futile. The erection of *Orthalicinus* in 1875 by Fischer and Crosse seems to me to be quite a needless addition to nomenclature, for if *L. fasciatus* is in need of a subgeneric name, *Oxystrombus* of Mörch fills every requirement.

*Key to species of Liguus.*

*a.* Columella deeply concave above, abruptly truncated at the base, sinuous within the last whorl.

*b.* Shell glossy and brilliant, usually with 3 to 6 distinct color-bands, somewhat trochiform; basal lip subhorizontal, but slightly arcuate. Haiti. *virgineus*, p. 162

*b*[1]. Somewhat pupiform, the last whorl rather contracted below; basal lip deeply arcuate. Cuba. *poeyanus*, p. 166

*a*[1]. Columella straight above, vertical, hardly or not sinuous within the last whorl, and either continuous or truncated at the base; basal lip rather deeply arcuate. Aperture not deep purple or pink within, though the parietal wall is often colored.

*b.* Pale yellow or whitish, with several blackish zones, one above and one below the periphery more or less maculated with yellow; columella but slightly truncated; last whorl somewhat contracted. *blainianus*, p. 174

*b*[1]. Without the above combination of characters. *fasciatus*, p. 166

Several species besides those defined above are referred to *Liguus* and its vicinity in Pfeiffer's *Nomenclator Heliceorum Viventium*. *L. carinatus* Pfr. (p. 206, no. 76) is a *Perideris*; *L. emarginatus* (p. 260) is a form of *L. virgineus*; and *Orthalicus* (*Corona*) *histrio* Pfr. (p. 259, no. 77) is a species of *Oleacina*.

L. VIRGINEUS (Linné). Pl. 56, figs. 58–69.

Shell ovate-turreted, solid, smooth and glossy. Color white or bright yellow, with distinct, vivid, *continuous* and rather narrow bands of blackish, brown, green, pink, purple, or light yellow, or two or three of these colors; the bands usually 3 to 6 in number, typical positions for three of them being the periphery, the middle of the upper surface (ascending the spire midway between sutures), and

the middle of the lower surface; the earlier whorls either white, pink or with the lower half of each one purple. Whorls 7 to 8, somewhat convex, the last either subangular or rounded at the periphery; apex obtuse, smooth.

Aperture small, oblique, varying from pure white to dark purple within, paler near the lip; peristome acute, unexpanded, the basal margin excised; *columella concave and deeply excavated above, its base abruptly truncated;* and with the parietal callus, of a deep pink color.

Alt. 52, diam. 27, longest axis of aperture 24½ mill.

Alt. 49, diam. 20, longest axis of aperture 20 mill.

Alt. 37, diam. 21½, longest axis of aperture 18 mill.

Alt. 36, diam. 17, longest axis of aperture 14½ mill.

Haiti: *Miragoane* (Rolle); *Jacmel* (Vendryes); *Aux Cayes* (Swift); *Gonave Island* (Linden); and in Santo Domingo, *environs of Santiago* (Hjalmarson), *Barrera, San Juan and Neyba* (A. Sallé).

*Bulla virginea* Linne, Syst. Nat. (12), p. 1186 (1766).—Chemnitz, Conchyl. Cab. ix, pt. 2, p. 8, pl. 117, f. 1002, 1003; and x, pl. 173, f. 1682, 1683 (sinistral form).—Gmelin, Syst. Nat. (13), p. 3429.—Dillwyn, Descript. Catal. i, p. 491.—Mawe, The Linnæan System of Conch., pl. 22, f. 6 (1823).—*Buccinum virgineum* Müller, Hist. Vermium ii, p. 143.—*Bulimus virgineus* Brug., Encycl. Méth. i, p. 363.—*Helix* (*Cochlitoma*) *virginea* Fer., Prodr., p. 49, no. 344.

*Achatina virginea* Lam., An. s. Vert. vi, pt. 2, p. 131; edit. Deshayes viii, p. 299.—Crouch, Illustr. Introd. Lam. Conch., 1827, p. 29, pl. 15, f. 5.—Reeve, Conch. Syst. ii, pl. 176, f. 2; Conch. Icon. pl. 10, f. 36.—Sowerby, Conchol. Man., f. 286.—Küster, Conchyl. Cab. pl. 7, f. 8, 9; pl. 14, f. 9, 10 (sinistral).—Deshayes in Fér., Hist., p. 152, pl. 118, f. 3, 4, (red banded form), pl. 120, f. 2–7, and 8 (sinistral).—Pfr., Conchyl. Cab., p. 300, pl. 24, f. 8–10; Monogr. ii, p. 255; iii, 489; iv, 604; vi, 221; viii, 277.—Binney and Bland, Amer. Jour. of Conch. vi, p. 209–211, f. 3, 4 (teeth); Land and Freshwater Shells of N. A. i, p. 212, f. 364 (jaw).—Hjalmarson and Pfeiffer, Malak. Blätter v, p. 153.—Drouet, Moll. Terr. Guyane Francaise, p. 69.—*Achatina virginiæ* Blainville, Man. de Malac., p. 456, pl. 38, f. 2.

*Chersina virginea* Beck, Index Moll., p. 74 (1837).

*Liguus virgineus* Montfort, Conch. Syst. ii, p. 423, pl. 106 (1810).—Binney and Bland, Ann. N. Y. Lyc. Nat. Hist. xi, p. 41, pl. 3,

f. A–G (teeth); pl. 4, f. G (genitalia).—Bland, t. c., p. 198.—von Martens, Jahrb. d. D. Malak. Ges. iv, 1877, p. 362–367.—Crosse & Fischer, Miss. Scient. Mex., Moll., p. 436.—Binney, Ann. New York Acad. Sci. iii, p. 129, pl. 12, f. A (dentition).—Crosse, Journal de Conchyl. xxxix, 1891, pp. 129, 204 (with var. *sinistralis* Maltzan, Ms.).—*Achatina virginea* varieties 2, 3, 4, Swainson, Zoöl. Illustr. iii, pl. 122, 123 (1822).—*Achatina* (*Liguus*) *virginea* Martens in Alb., Die Hel., 1860, p. 207.—*Pseudotrochus virgineus* H. & A. Adams, Gen. Rec. Moll. ii, p. 135, pl. 73, f. 8a.

*Achatina vexillum* Humph., DeKay, Zoöl. of New York, pt. v, Moll., p. 56, pl. 4, f. 56.

*Achatina emarginata* Swainson, Zoöl. Illustr. ii, pl. 84, upper and lower figures (1821).—Pfr., Monogr. ii, p. 256.—*Ilotia virginea* and *puellaris* Bolt., teste Pfr.—*Chersina vittata* Humphrey, Mus. Calonnianum, p. 62 (1797).

*Pre-Linnean illustrations:* Lister, Historia Conch., pl. 15, f. 10. Buonanni, f. 66; Argentville, pl. 65, f. G 1, G 3, G 4, G 5. Klein, pl. 7, f. 116 (copied from Lister). Petiver Gazophylacii, pl. 22, f. 11 (copied from Lister). Gualtieri, pl. 6, f. A. Seba, Thesaurus iii, pl. 40, f. 38. Schröter, Geschichte der Flussconchylien, p. 337, pl. 8, f. 3, 4.

*L. virgineus* differs from *L. fasciatus* in the shorter columella, strongly concave above and more abruptly truncated below, and in being more trochiform. The columella is strongly sinuous within the last whorl, and there is frequently a short callous ridge well within the aperture on the basal wall. The positions of the four blackish bands, when they are present, is always the same, and the dark green (or purple) super-peripheral band, ending in a slight notch in the lip, is also fixed in position when present. The green band is purely cuticular, and when rubbed off, a purple one is seen in the substance of the shell beneath it. The number of band combinations, if one descends to minutiæ and transition forms, is considerable; but the chief patterns are noticed below. The variation in width of the shell is largely independent of color-pattern.

I. With a super-peripheral green band terminating in a notch at the lip-edge.

Ia. One green band and some faint yellow ones; aperture white within (figs. 58, 59). This is *Achatina emarginata* of Swainson. It occurs at Jacmel.

I*b*. Two to four blackish bands in the typical positions, a red band above the peripheral one or replacing it; aperture dark within (figs. 63, 64.)

$b^1$. A second green band above, both bordered below with yellow.

I*c*. Ground color yellow, fading to white or pink above; a red line above the dark green super-peripheral band, and a red band at periphery; grass-green bands at suture and base; aperture white inside (figs. 61, 62). Aux Cayes.

II. Green bands wanting or replaced by purple.

II*a*. Four dark lines in the typical positions, the lower two bordered above by red bands or wanting (figs. 68, 66).

II*b*. Three red bands, no dark ones (fig. 69).

II*c*. Four dark bands or lines only, in the typical positions (figs. 67).

According to Hjalmarson, *L. virgineus* lives upon the tree *Hæmatoxylon campecheanum*, the Campeche wood, used for dyes. In water the dye diffuses a reddish-yellow color; acted upon by acids, it becomes yellow or red; by alkalies, violet, purple or blue. These are the colors chiefly found in the shell. The epiphragm and the slime of the snail are green.

Sinistral specimens have been figured by Chemnitz, Küster and Férussac, and Rolle reports the sinistral with the typical form at Miragoane.

From the data at hand, it would seem that the chief color-patterns are probably local, all the shells of one "colony" being somewhat similar, though the same color-form may occur in many separated places. Further investigation is required to definitely speak on this point. Probably sinistral shells occur of any color-pattern, and are wholly sporadic; and in that case v. Maltzan's "var. *sinistralis*" will not stand for anything of the nature of a race or variety in the true sense.

As Haiti was the first Antillean island to be settled, and for a long time was visited for provisions by most vessels trading to the West Indies and Spanish Main, this brilliant shell was early carried to Europe, and is figured in most of the iconographic works of the last century. Naturally, the habitats given by the older authors scattered it wide of the mark. Linné cites figures of *L. fasciatus* as a var. $\beta$ of

*virgineus*, an error detected by Bruguière. Drouet gives it among his Guiana shells, from a locality near Cayenne. If it exists there, it was evidently introduced by French commerce.

L. POEYANUS (Pfeiffer). Pl. 55, figs. 55, 56, 57.

Shell dextral or sinistral, oblong-turreted, somewhat fusiform, solid, whitish, becoming deep pink above, and more or less yellow on the latter part of the last whorl, with three narrow brownish black bands in the typical positions, sometimes with a light chestnut band bordering the suture below and a chestnut patch around the columella. Smooth and glossy, whorls 8, moderately convex. Aperture oblique, pink within; outer lip acute and simple; columella and parietal wall rose-colored, the former destroyed by crabs in the specimens known, but said by Poey to be truncated.

Alt. 43–48, diam. 18–20 mill.

*Cabo Cruz*, *Cuba* (Gundlach, Jaudenes).

*Achatina poeyana* PFR., Malak. Blätter iv, p. 173, pl. 4, f. 3, 4 (1857); Monogr. iv, p. 605; vi, 221.—ARANGO, Fauna Malacologia Cubana, p. 94.—*Liguus poeyanus* Crosse, Journ. de Conchyl. 1890, xxxviii, p. 202.—? *Achatina vittata* SWAINSON, Zoöl. Illustr. pl. 84, middle figures (1821–2).

Similar to *L. virgineus*, and unlike all other Cuban *Liguus*, in the three blackish bands in the typical positions for bands in this subfamily. The pink-calloused interior, narrow form and smooth surface, as well as the truncated columella, are also like *L. virgineus*, from which species it differs chiefly in *distribution*. The tapering base of the last whorl, however, is not quite like *virgineus*.

The shells collected by Gundlach and sent Pfeiffer had all been inhabited by Paguri, the columella being worn away. Those before me are also in this condition. According to Gundlach the majority of the specimens are sinistral. None have been observed with green, purple or red bands, though the spaces between the peripheral and upper, and below the lower dark band, become straw-yellow on the latter part of the last whorl in one of the shells before me.

I think Swainson's *A. vittata* corresponds much better with this species than with *L. virgineus*, but as there is some doubt, I do not give it precedence.

L. FASCIATUS (Müller). Plates 57, 58, 59, 60; pl. 55, fig. 54.

Shell oblong-conic, thin or solid, smooth. Color variable, being

white, banded or streaked. Whorls $6\frac{1}{2}$–8, moderately convex. Aperture ovate, oblique; outer lip simple, thin, more or less notched at the terminations of green bands when these are present; *columella vertical, straight above*, varying from heavy and strongly truncate below (in typical *fasciatus*) to thin and continuous with the basal lip (in var. *crenatus* etc.).

Alt. 73, diam. 34, longest axis of aperture 33 mill.

Alt. 60, diam. $26\frac{1}{2}$, longest axis of aperture 25 mill.

Alt. 50, diam. 27, longest axis of aperture 25 mill.

Alt. 41, diam. 17, longest axis of aperture $17\frac{1}{2}$ mill.

*Cuba and the Isle of Pines; Cozumel Island*, off the east coast of Yucatan; *Florida Keys, and northward on the east coast to Miami, on the west to Goodland Point.*

*Bulla virginea* β Linne, Syst. Nat. (12), p. 1186.

*Buccinum fasciatum* Müller, Verm. Terr. et Fluv., ii, p. 145 (1774), referring to Seba, Thesaurus III, pl. 39, f. 62–64, 67, 68, 74 (but f. 62–74 are all *fasciatus*). Argenville, Conch. (1757), pl. 11, f. M. Berlinisches Magazin, iii, (1766), pl. 5, f. 52. Regenfus, Conchyl. pl. 10, f. 46. Lister, pl. 12, f. 7. Gualt. Test. Conchyl. Index, pl. 6, f. D. Klein, Ostrac., pl. 2, f. 43, etc.

*Bulla fasciata* Chemnitz, Conchyl. Cab., ix, pt. 2, p. 13, pl. 117, f. 1004–6.—Gmelin, Syst. Nat. (13), p. 3430.—Dillwyn, Descript. Catal. i, p. 362.

*Achatina fasciata* Swains., Zoöl. Illustr., ii, pl. 74; iii, pl. 162. —Reeve, Conch. Syst. ii, pl. 178, f. 11, 12; Conch. Icon. pl. 9, f. 29, pl. 10, f. 35 a, b, c.—Orb., Moll. Cuba i, p. 172, pl. 6, f. 1–7.—Pfr., Monogr. ii, p. 245; iii, 479; iv, 604; vi, 221; viii, 277; Conchyl. Cab. p. 298, pl. 24, f. 1–3; pl. 47, f. 3–6.—Deshayes, in Fér., Hist., ii, p. 148.

*Chersina fasciata* Beck, Index Moll., p. 74.

*Achatina* (*Chersina*) *fasciata* Pfr., Malak. Bl. i, 1854, p. 197.—*Achatina* (*Corona*) *fasciata* Pfr., Malak. Bl. ii, 1855, p. 167.—*Oxystrombus fasciatus* Morch, Journ. de Conchyl. 1865, xiii, p. 270. *Orthalicus* (*Orthalicinus*) *fasciatus* Crosse & Fischer, Miss. Scient. Mex., Moll., p. 436.—Crosse, Journ. de Conchyl. 1890, p. 201.

*Bulimus vexillum* Brug., Encycl. Méth. i, p. 362.

*Helix* (*Cochlitoma*) *vexillum* Fér., Prodr. 49, no. 343; Histoire, pl. 121, f. 1–8.

*Achatina vexillum* Lam., Anim. s. Vert. vi, pt. 2, p. 130; edit. Desh., viii, p. 298.—Küster, Conchyl. Cab. p. 7, f. 1–3.

*Achatina pallida* SWAINSON, Zoöl. Illustr. i, pl. 41 (1820).

*Achatina crenata* SWAINSON, Zoöl. Illustr. i, pl. 58 (1821).—*Chersina crenata* BECK, Index Moll., p. 74.

*Achatina anais* LESSON, Revue Zoöl. 1840, p. 356 (1841).

*Achatina lineata* VALENC. in Humb. & Bonpl. Rec. de Obs. Zoöl. ii, p. 248, pl. 55, f. 2 (1833).

*Achatina lutea* (in Berlin Mus.) ANTON, Verzeich. p. 44 (1839), nude name.—*A. lutea* WIEGMANN (unpublished).

*Achatina murrea* REEVE, Conch. Icon. pl. 7, f. 22 (1849).—*Pseudotrochus murreus* H. & A. ADAMS, Gen. Rec. Moll. ii, p. 135.

*Achatina picta* REEVE, P. Z. S. 1842, p. 56; Conch. Syst. ii, p. 178, f. 10; Conch. Icon. pl. 10, f. 34.—PFR., Monogr. ii, p. 256; iii, p. 490; iv, 605; vi, 221.—*Pseudotrochus pictus* H. & A. ADAMS, Gen. Rec. Moll. ii, p. 135.—*Liguus picta* CROSSE, Journ. de Conchyl. 1890, p. 201.

*Helix hepatica* and *H. testa ovis* BOLTON, according to Pfeiffer.

*Chersina vexillum* HUMPHREY, Mus. Calon., p. 62.

(*Floridian references.*)

*Achatina solida* SAY, Journ. Acad. Nat. Sci. Phila. v, p. 122 (1825); Edit. Binney, p. 29.—DEKAY, N. Y. Moll., p. 56.—PFR., Monogr. ii, p. 246.

*Agatina variegata* RAFINESQUE, Enum. and Acct. p. 3 (1833); edit. Binney & Tryon, p. 68.

*Bulimus fasciatus* BINNEY, Terrestr. Moll. U. S. ii, p. 266, pl. 55–57; and LEIDY, ibid. i, pl. 5 (anatomy).

*Achatina fasciata* W. G. BINNEY, Terr. Moll. iv, p. 138; BINN. & BLAND, Land and Fresh-water Shells N. A., i, p. 213, f. 365 (shell), 366 (teeth).

*Liguus fasciata* TRYON, Amer. Journ. Conch. iii, 1867, p. 165, pl. 12, f. 1, 2, 3, 5, 6. (Cuban specimens!)—*Liguus picta* TRYON, l. c. p. 165, pl. 12, f. 4 (a Cuban specimen!)

*Liguus fasciatus* W. G. BINNEY, Terrestr. Moll. v, p. 403, pl. 55, 56, 57 (shell), pl. 10, f. G (dentition); Man. Amer. Land Shells, Bull. 28 U. S. Nat. Mus., p. 432, f. 478 (teeth), 479 (1885); Fourth Supplement to Terr. Moll. v, Bull. Mus. Comp. Zoöl. xxii, no. 4, p. 201, pl. 1, f. 5 (1892).—SIMPSON, Proc. Davenport Acad. Nat. Sci. v, p. 67.—RHOADS, Nautilus xiii, p. 45.

The typical *L. fasciatus* is a solid, strong shell with the columella

heavy and generally truncated, and a rich color-pattern of dark zones and lines on a white or light ground, as shown in figures 70–74 of plate 57. All of the older and especially the pre-Linnean figures represent this form. It is a superb shell, with the appearance of painted porcelain. *B. vexillum* Brug., *A. lineata* Val. are absolute synonyms, and *A. murrea* Rve. is the young. The *Achatina pallida* of Swainson is a form of *L. fasciatus* retaining only a small part of the typical color pattern. Var. *pictus* Reeve is another branch of the typical *fasciatus* stem, in which the longitudinal stripes have become obsolete except at the ends, where they appear as spots. It is often thinner than typical *fasciatus*.

I am convinced that no specific separation can be made between the shells with strongly truncate columella and those with no truncation. It is a character of less phylogenetic stability than the mere color-pattern; truncate and non-truncate specimens occur together in many localities, with all possible intergradations between them. The contention of MM. Crosse and Fischer that *L. fasciatus* should be removed from *Liguus* to *Orthalicus*, under the subgeneric title of *Orthalicinus* was apparently based upon an incomplete knowledge of the variations of the columella; and such an arrangement of the forms as that given by M. Crosse in J. de C. xxxviii, 1890, p. 201, is clearly inadmissible.

No shells corresponding to this typical form and its color-variations occur in Florida. They are exclusively Cuban. A form parallel with var. *pictus* Reeve occurs in Florida (var. VII), but it evidently had a different genesis.

The variety *crenatus* of Swainson, so named from the nicks in the peristome at the ends of the green bands, is the oldest name for the thin form with numerous green lines, occurring both in Cuba (pl. 58, figs. 80, 81) and in Florida (pl. 60, figs. 1, 2, 3). It is likely that this form was the original one which reached Florida, the other peninsular varieties being derivatives therefrom. Var. VIII occurs both in Florida (pl. 59, figs. 92, 93), and in Cuba (as var. III, pl. 57, fig. 76). The uniform white Cuban form (pl. 58, fig. 88) is not quite like the white Floridian form (pl. 59, figs. 94, 96) and evidently arose from diverse antecedents.

Very little is known of the distribution of the color-varieties in Cuba. The heavy, beautifully painted typical forms, variety I and its subvarieties, occur in western Cuba and the Isle of Pines. This

is also the pattern occurring in Cozumel Island, where one specimen (pl. 58, fig. 83) was collected in 1899 by Dr. C. F. Millspaugh during the West Indian cruise of the yacht "Utowana." It was found on the trunk of a low Sabal palm about two feet from the ground, and about 500 feet from the beach.

It does not seem to me desirable to apply names to the numerous forms of *L. fasciatus* until they are far better understood than at present; but a synopsis of the main variations may be useful.

*Cuban varieties.*

I. *Typical form.* Solid and strong, the columella more or less truncate; white with a broad belt varying from purplish-pink to bluish above and another below the white peripheral band, which is usually divided by a brown line; the colored belts generally with greenish lines and dark flames; spire flammulate, with spiral lines at the sutures; columella and apex pink or white; parietal callus often pink-edged (pl. 57, figs. 70, 71, 72). Cienfuegos, etc. Through various transitions this blends with form I*a*.

The *Cozumel Island form* is somewhat similar to the above. It is solid with distinctly truncated columella; with two wide blackish bands, traversed by darker lines and somewhat spotted with yellow, on a white ground becoming yellowish below and pink near the apex, the bands gradually disappearing on the latter half of the last whorl, and replaced by several greenish lines. (pl. 58, fig. 83).

I*a*. Similiarly solid, large, the columella varying from very strongly to weakly truncate. White, often yellowish on the last whorl, with a brown line at the periphery, and numerous grass-green or yellowish-green lines and narrow bands, and more or less streaked or maculated with purplish above; parietal callus often with a dark chestnut border, and some sigmoid streaks within (pl. 57, figs. 73, 74).
Transitions towards var. *crenata* occur.

I*b*. Similar to *a*, but green lines wanting or faint (*A. pallida* Swains., pl. 58, fig. 82). The lack of green lines is often due to wear. The chestnut streaks upon the parietal callus are often conspicuous. This form sometimes attains a length of 70–75 mill.

Ic. No bands except a white one at the periphery; striped with deep brown, like an *Oxystyla* (pl. 57, fig. 75). An unusual color-variety.

II. Rather smaller, alt. 40–50 mill., solid, the columella more or less, or not, truncated; white or yellowish, with a few longitudinal bluish or purplish smears, and a double row of brown or bluish spots at the periphery and suture; apex and columella pink or white (*A. picta* Reeve. Pl. 58, figs. 84, 85). This is a modification of var. I; compare fig. 74 of pl. 57.

III. Rather small and stoutly conic; white, some whorls of the spire with a wide blackish-brown zone, replaced upon the penultimate or last whorl by some green lines, or continuous to the aperture, with another dark zone on the base of the shell; apex and aperture either white or pink (pl. 57, fig. 76).

IV. Small and slender, rather thin; a white peripheral zone, with longitudinal bluish, greenish or purplish streaks above and below, the streaks either distinct or lost in a general purplish-fleshy suffusion. Columellar truncation weak or scarcely noticeable, parietal callus thin, faint pink; apex often dark-tipped; aperture small (pl. 57, fig. 79). Pinar del Rio.

V. Pure white throughout, or with a faint pink tint on the parietal wall. Columellar truncation varying from very strong to imperceptible. (Pl. 58, fig. 88).

VI. Var. *crenatus* Swains. Rather thin, the columella straight, slightly or not at all truncated. White, with numerous grass-green lines, the earlier whorls, columella and thin parietal callus white or nearly so. (*A. crenata* Swains.; *A. anais* Lesson. Pl. 58, figs. 80, 81). This form differs from Var. I*a* in wanting dark markings on the spire and parietal wall. There is sometimes a brown peripheral line.

*Floridian varieties.*

VI. White, with few or numerous grass-green lines, sometimes coalescent into bands; no brown line at periphery or elsewhere. Apical whorls and parietal callus white or pink. (var. *crenatus* Swains., pl. 60, figs. 1, 3, 5). These are the same as the Cuban *crenatus*. The bands are sometimes dull instead of bright green, or even olive-brown.

VI*a*. Similar, but more or less tinted or broadly zoned with

yellow, varying to forms with no green lines and bright yellow color (pl. 60, figs. 10, 12, 13, Miami, Fla.).

VI*b*. Similar to VI, but with a broad interrupted blackish zone or series of blotches on one or two whorls of the spire; sometimes a brown line at the periphery (pl. 60, fig. 2).

VI*c*. Similar to VI*b*, but the broad interrupted zones extend to the last whorl, with or without green lines, the intervals between dark blotches often yellow (pl. 60, figs. 4, 8, Miami, Fla.).

VI*d*. Last whorl elaborately streaked with black-brown, a light band at periphery and suture (pl. 60, fig. 7, Miami; also pl. 20, figs. 27, 28).

VI*e*. Streaks reduced to series of spots below the suture and at the periphery (pl. 60, fig. 11, Miami, Fla.). This form resembles and is a transition to the next, but is more heavily marked.

VII. Thin and light, the columella slender, not truncated. Delicately greenish-yellow tinted, pale above, smeared longitudinally at irregular intervals with bluish or purplish, more copiously streaked on the upper whorls; having more or less developed sub-sutural and peripheral bands of spots; brown bands at periphery and suture, with another above the suture; and some green lines (pl. 59, figs. 90, 91, Lignum Vitæ Key), or none (pl. 59, fig. 97, No Name Key) on the last whorl. Apex and parietal wall faintly pink-tinted. Similar to var. *picta* Rve., but thinner, with slender columella, and a white band between the suture and the row of spots below it.

VIII. A broad blackish zone on the spire, two on the last whorl, on a white ground (pl. 59, figs. 92, 93, Key Largo). This connects with VI*b* and the following form though specimens with the dark zones absent on the last whorl, and replaced by lines or a uniform white surface. In some shells the bands are yellow with brown streaks.

IX. White, with faint pinkish or gray streaks, the apex and columella pink (pl. 59, fig. 94, Key Largo). Also occurs at Goodland Point.

X. Solid and strong, pale yellow, or white with yellow zones,

the columella truncated at base (var. *solida* Say, pl. 58, fig. 86, Say's type; also fig. 87).

In Florida *L. fasciatus* is said to range from Key West to Miami, and northward on the west coast to Goodland Point. It is definitely known from the following keys and mainland localities:

*Key West* (Binney); which color form is not recorded.

*Pine Key* (Simpson); "a very large form, greatly elongated with flattened whorls and beautifully marked with brown, green, blue and purple on a yellow ground, columella and tip of spire pink. One living shell found, of a chalky-white throughout, having a single very narrow olive line on the body and next whorl, the columella being as distinctly truncated as most of the African Achatinas."

*No Name Key* (Hemphill). See Var. VII above, and pl. 59, fig. 97. Delicate mottled shells, resembling those from Lignum Vitæ Key, and the var. *pictus* of Cuba.

*Key Vaccas* (Hemphill). See pl. 59, fig. 95. "Small, thick, four upper whorls white with longitudinal dark chestnut blotches, lower three whorls very dark green, almost black, with white longitudinal flammules and black revolving bands."

*Grassy Key* (Joseph Willcox). Pure white, with pale olive-green lines. Two specimens.

*Rabbit Key* (Simpson). "Variety having a wide brown band."

*Lignum Vitæ Key* (Willcox). See var. VII, above, and pl. 59, figs. 90, 91. Delicately mottled with purple and lineate with green. Resembles the form from No Name Key. Four specimens examined.

*Key Largo* (Hemphill). (*a*) Pinkish-white, with some grayish streaks, the apex and columella pink; pl. 59, fig. 94. (*b*) The same, with pale green lines on the last whorl. (*c*) White with two wide black or red-brown bands, the upper one ascending the spire, pl. 59, fig. 93, or the bands yellow with brown streaks, pl. 59, fig. 92, and sometimes wanting on the last whorl or replaced by greenish lines there. Thirty-two specimens.

*Biscayne Key* (Binney). Color forms not recorded.

*Miami*, Dade Co., on the mainland (S. N. Rhoads, H. A. Pilsbry). This is apparently near or at the limit of distribution northward on the east coast of Florida. See varieties VI, VI*a*, VI*b*, VI*c*, VI*d*, VI*e*, and pl. 60, all figures. The earlier whorls and columella are indifferently white or pink in all the color-forms. The color-patterns are somewhat localized, some colonies affording green-banded shells

only, while in others many dark specimens occur also. The more elaborately-marked forms, such as VI*d* and VI*e* are rare at Miami, the forms VI and VI*a* greatly predominating.

*Cape Sable*, S.-E. Florida (Simpson, Willcox). White, with pink apex and columella, the later half of the body-whorl with a *pink* peripheral line and numerous light greenish lines; solid and strong, with the columella either heavy and strongly truncated, or the truncation scarcely noticeable (pl. 59, fig. 96, coll. by Willcox). Simpson writes: "Some of the shells marked with a broad spiral band of brilliant orange, and on one shell the band was green."

*Goodland Point*, Lee Co., on the west coast, about 40 miles south of Charlotte Harbor (Simpson, Hemphill). This is the most northern point from which the species is known, though Mr. Simpson mentions a report of its occurrence on Sanibel Island. It ascends decidedly further on the west than on the east coast. The shells collected by Hemphill are white with the apex and columella pink, last one or two whorls with a broad yellow zone or two, and sometimes numerous yellowish-olive lines toward the end of the last whorl. Simpson mentions them as either pure white or slightly marked with greenish or brown lines on the body-whorl. It occurs in abundance.

It will be obvious from the foregoing that certain color-patterns are locally restricted; but until many more of the keys are explored and ample series collected with data on the stations, etc., no definite conclusions on the distribution of the color-varieties can be formulated. The exact habitats of some forms, such as the *solidus* of Say, are unknown.

L. BLAINIANUS (Poey). Pl. 55, figs. 51, 52, 53.

Shell oblong-turreted, rather solid. Cream-white or yellowish-white, with five black-brown spiral bands: the upper one a mere line below the suture, the second and fourth wide zones more or less broken by reddish or yellow streaks, the third or peripheral narrower, continuous, and the fifth band encircling the columellar region or forming a columellar patch. The first, third and fifth bands are sometimes replaced by diluted purplish or purple-brown bands (fig. 53), and the degree of maculation of the two main zones varies within wide limits. Surface smooth. Whorls $7\frac{1}{2}$, the apex blackish at the tip when not removed, several whorls following reddish, with a pale subsutural border.

Aperture small, oblique, whitish or maculated within; outer lip acute; columella vertical, moderately heavy, somewhat truncated at the base; the parietal and columellar callus more or less pinkish, the former rather thin.

Alt. 43, diam. 19, longest axis of aperture 19 mill.

Alt. 38, diam. 17, longest axis of aperture 17 mill.

*Sierra de Rangel*, in the cordillera de los Organos, about 30 leagues S. S.-E. from Havana, Cuba.

*Achatina blainiana* Poey, Memorias sobra la Hist. Nat. de la isla de Cuba i, p. 206, pl. 12, f. 4–6 (1851).—Pfr., Zeitschr. f. Malak. 1852, p. 176; Conchyl. Cab., p. 364, pl. 24, f. 4, 5; Monogr. iii, p. 489; iv, 605; vi, 221.—Gundlach, Malak. Blätter iv, 1857, p. 45.

Poey mentions a specimen 47 mill. long, but the ordinary size is about 40 mill. It is closely allied to *L. fasciatus*, with which Arango unites it, but may be distinguished by the more compressed or contracted last whorl, and the particular pattern of coloring, which does not vary materially in the small series of some 23 specimens before me. Still, there are certain forms of *fasciatus* which approach *blainianus*, and when full series from the region adjacent to its locality are collected, I do not have much doubt that *blainianus* will be given subspecific rather than specific rank.

Subgenus Corona Albers, 1850.

*Corona* Albers, Die Heliceen, p. 193 (for *Achatina regina* Fér. and *A. flammigera* Fér.).—Shuttleworth, Notitiæ Conchologiæ i, p. 66 (1856).—Von Martens in Die Hel. edit. 2, p. 226 (type *O. regina* Fér.).—*Bulimus* and *Achatina* sp., of various authors.—*Helix*, subg. *Cochlitoma* sp. of Férussac. Not *Corone* Kaup, 1829 (Aves), nor *Coronus* Dej., 1833 (Coleoptera), nor *Coronia* Ehrenberg.

Shell lengthened, ovate-conic, solid, sinistral or dextral, without spiral striation; apex obtuse, the first whorl planorboid above, smooth, the following $1\frac{1}{2}$ whorls of the nepionic shell irregularly striated or wrinkled in the direction of growth-lines, when unworn. Aperture oblique, the outer lip unexpanded, thin, the inner margin covered with a blackish callus and deeply excavated at the root of the columella; columella twisted, with a heavy callous fold, usually more or less distinctly truncate at base. Soft anatomy unknown.

Type: *Helix* (*Cochlitoma*) *regina* Fér.—See plates 33 to 36*a*.

Distribution: Eastern side of the Andes from Bolivia to Ecuador, eastward to the province of Bahia and to Guiana.

This group is still unknown anatomically. In shell-characters it seems more nearly allied to *Hemibulimus* than to other known subgenera of *Orthalicinæ*, agreeing with that group in the vertically wrinkled nepionic shell, the deeply excised inner lip, and the truncate columella. It differs from *Hemibulimus* in the brighter coloration, and heavily calloused columella. The structure of the columella is remarkably like some species of *Metorthalicus*, a group distinguished by its pitted apical sculpture, and thick outer lip.

Albers, Pfeiffer, Shuttleworth, von Martens and others have included a greater or less number of incongruous species in *Corona*. Excluding these, the subgenus consists of a group of very closely allied forms, which when full geographic series are collected and studied may prove to be varying races of a single species. Cousin has taken this view (Bull. Zoöl. Soc. France, vii, 1889, p. 193); but the obvious errors of fact and crudities of judgment everywhere apparent in his "Fauna Malacologique de la Républic de l'Equateur," and particularly so in his paragraphs upon *Corona regina*, do not recommend his views to us.

The distribution of several of the forms is involved in obscurity. *L. regalis*, with its variety *loroisianus*, is known to be a species of the upper Amazon, in Eastern Peru and Ecuador, and western Brazil, *L. incisus* inhabits the forests east of the Cordillera in Bolivia, and apparently occurs also in the province of Bahia and in Guiana. This is a wide range, and the identity of the Guiana shells with those of Bolivia is not absolutely certain. Of *L. perversus* I have an apparently authentic specimen from Demerara; but no habitat is yet known for the typical *L. regina*.

When the wide gaps in distribution indicated above are narrowed, and large series from single localities are collected, the number of species and their limits may become clear to us. Meantime these are open questions; and in declining to "lump" them I should not be understood as holding the opinion that the forms are distinct species; I merely desire to leave the subject in convenient order for those who come after. To this end the several forms have been discriminated and the whole literature rearranged. Should the group be reduced to a single species, the name *perversus* Swains., will take precedence over *regina* Fér. for the whole assemblage.

There are several names similar to *Corona*, and of earlier date, in use in zoölogy. If the molluscan group-name be considered preoccupied by any of them, it may be called *Paraliguus*.

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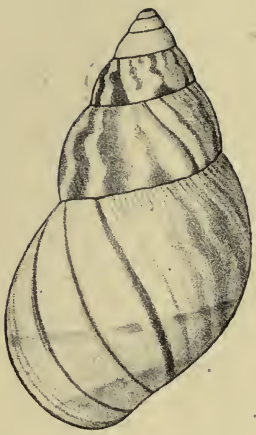

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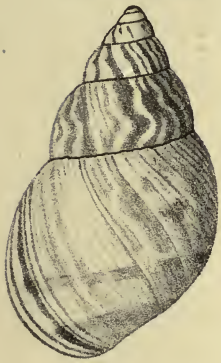

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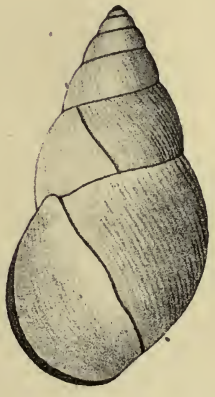

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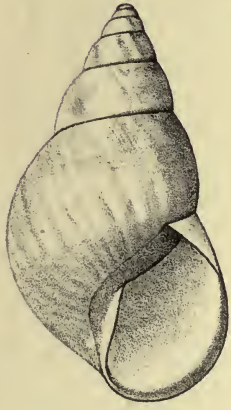

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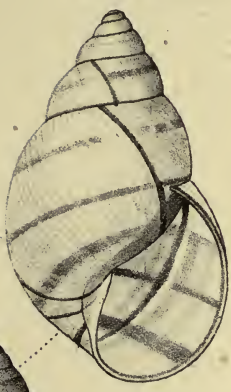

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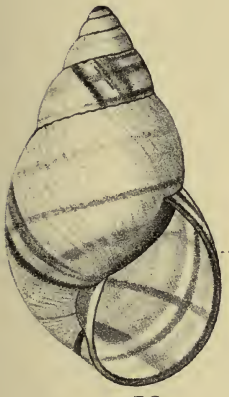

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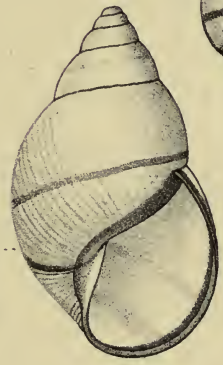

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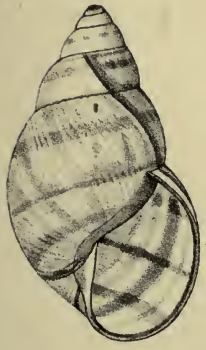

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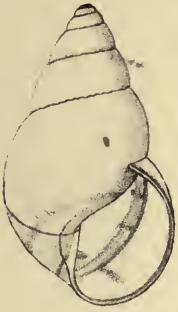

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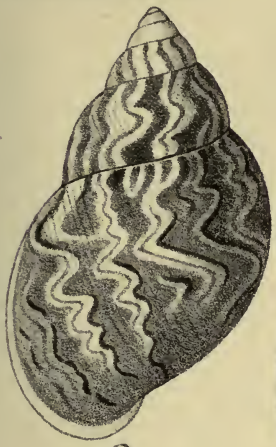

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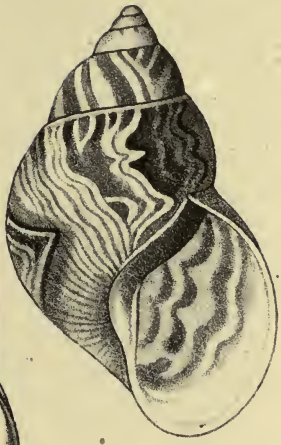

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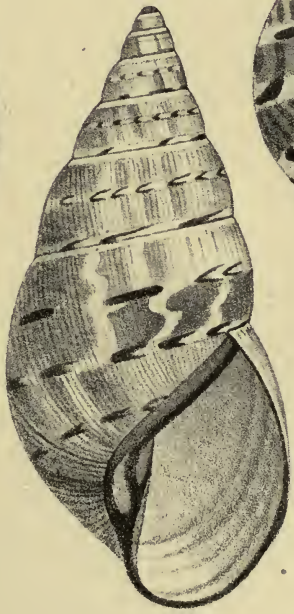

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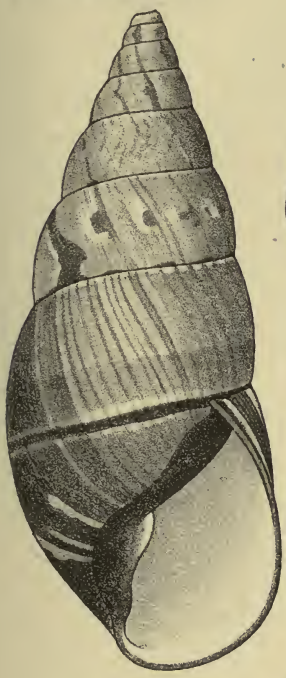

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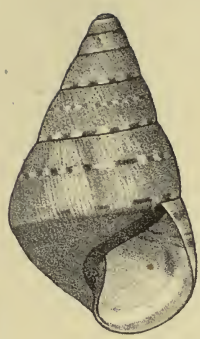

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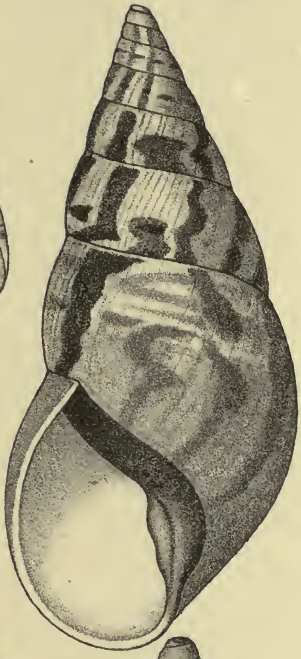

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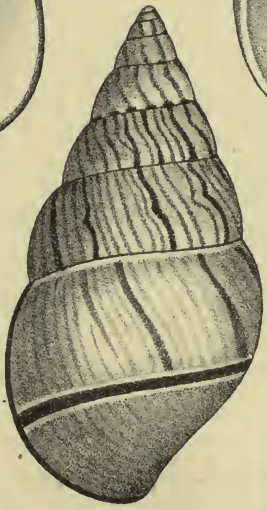

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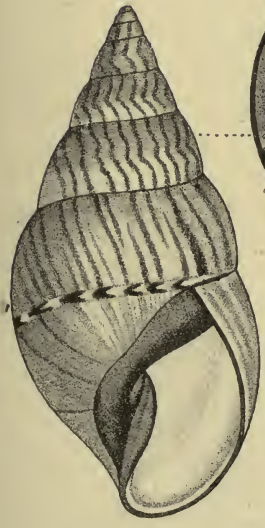

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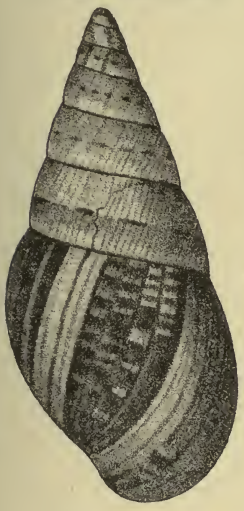

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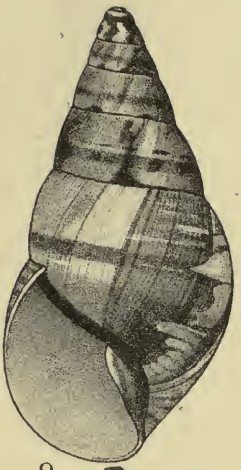

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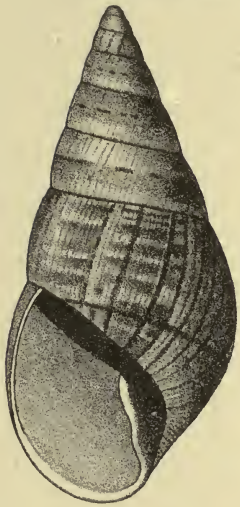

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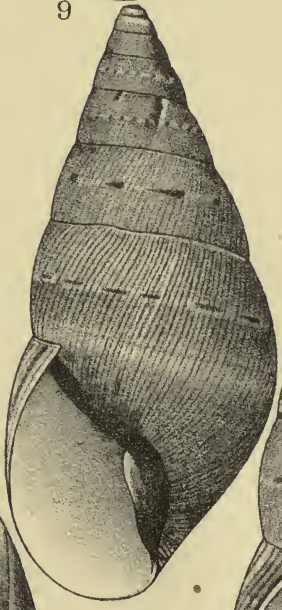

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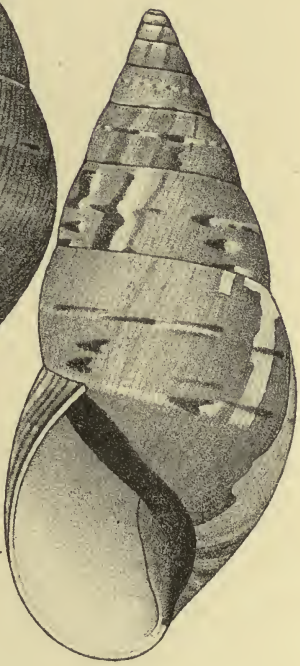

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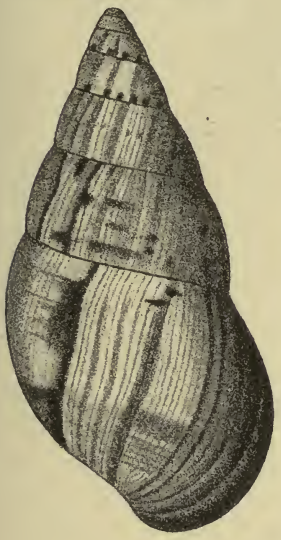

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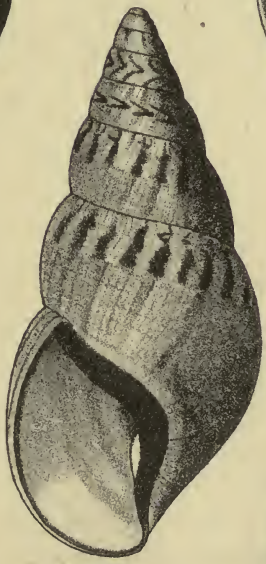

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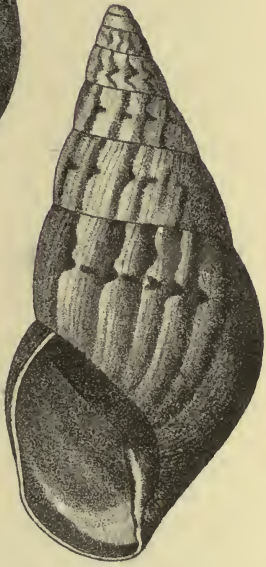

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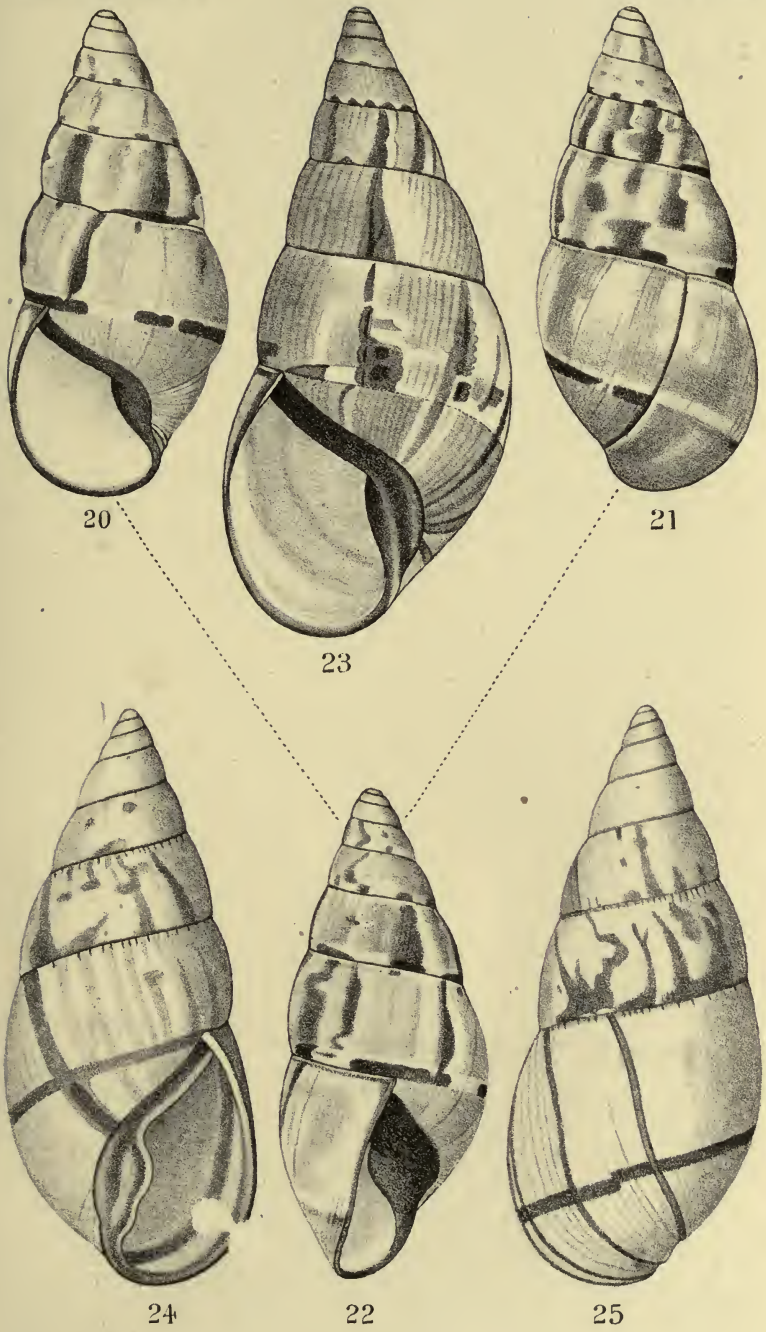

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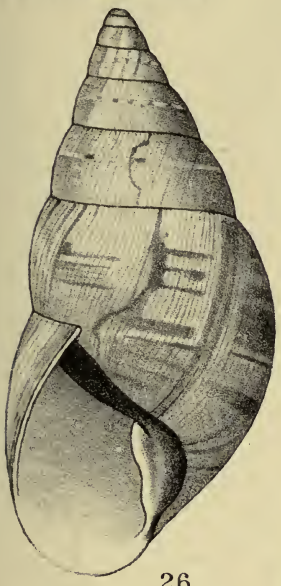

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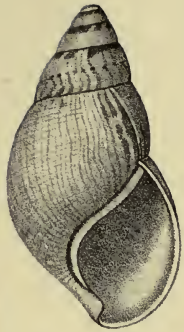

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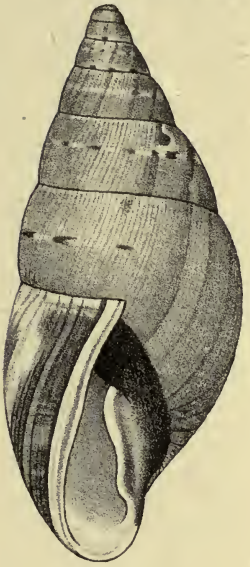

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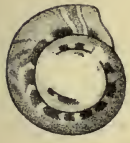

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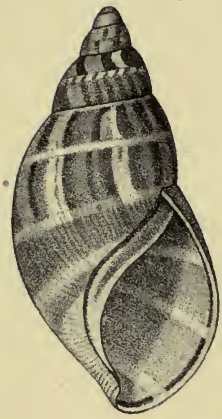

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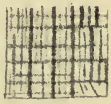

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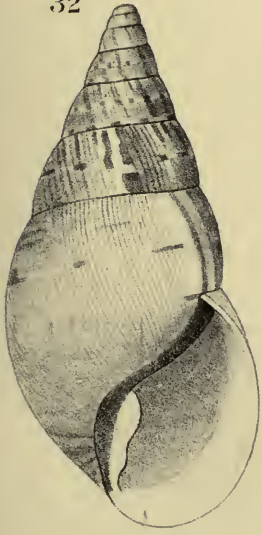

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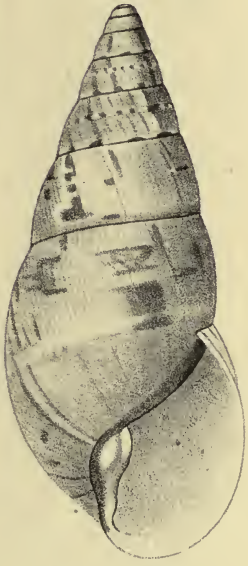

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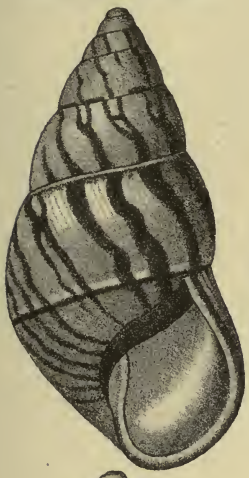

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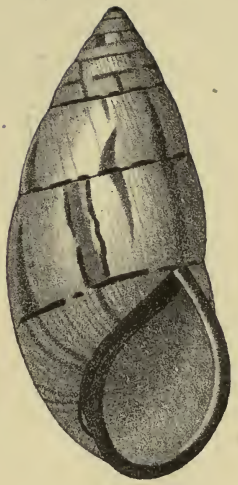

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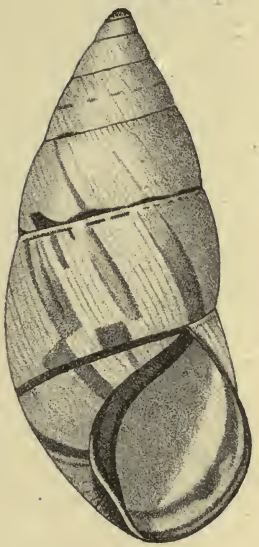

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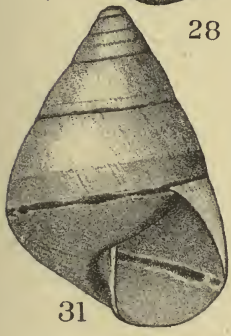

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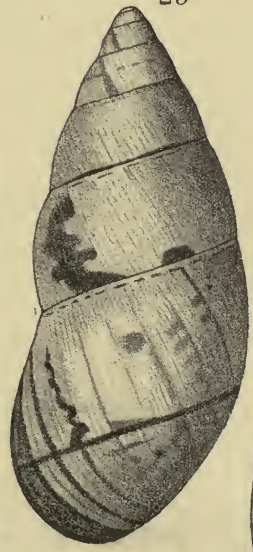

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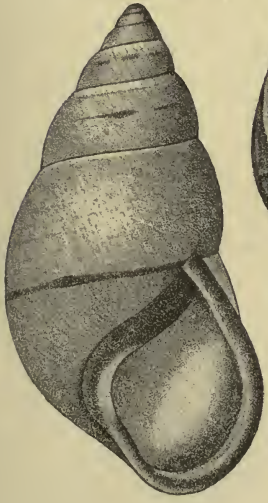

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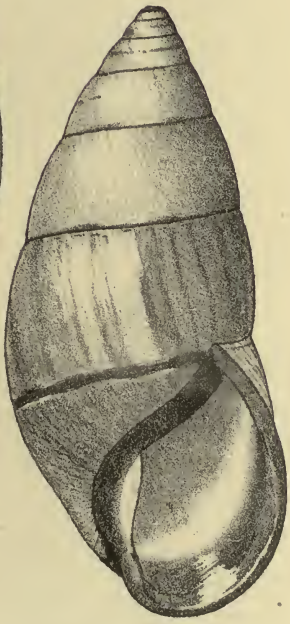

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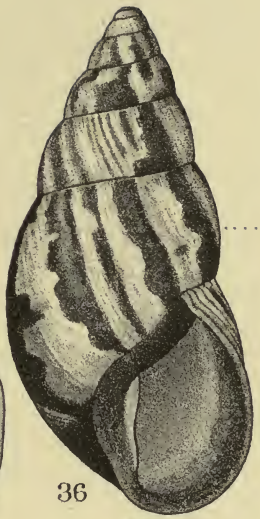

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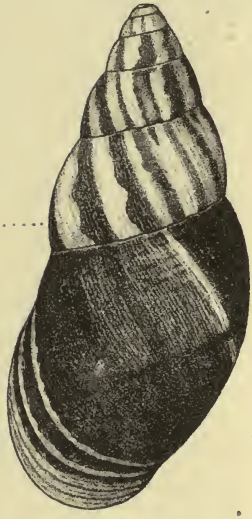

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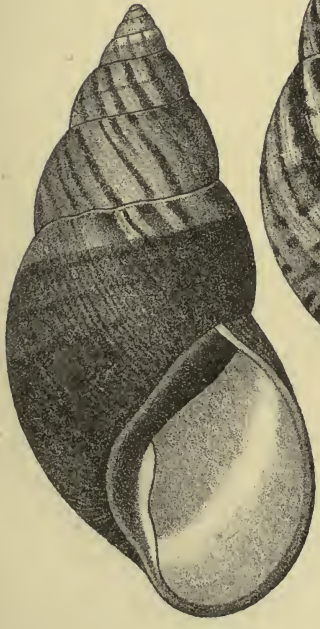

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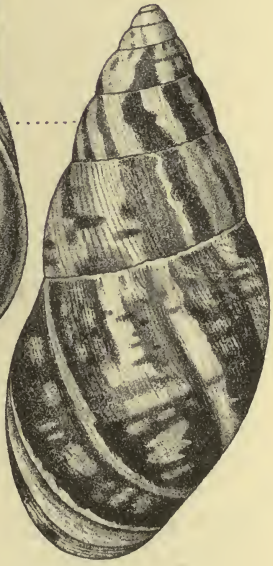

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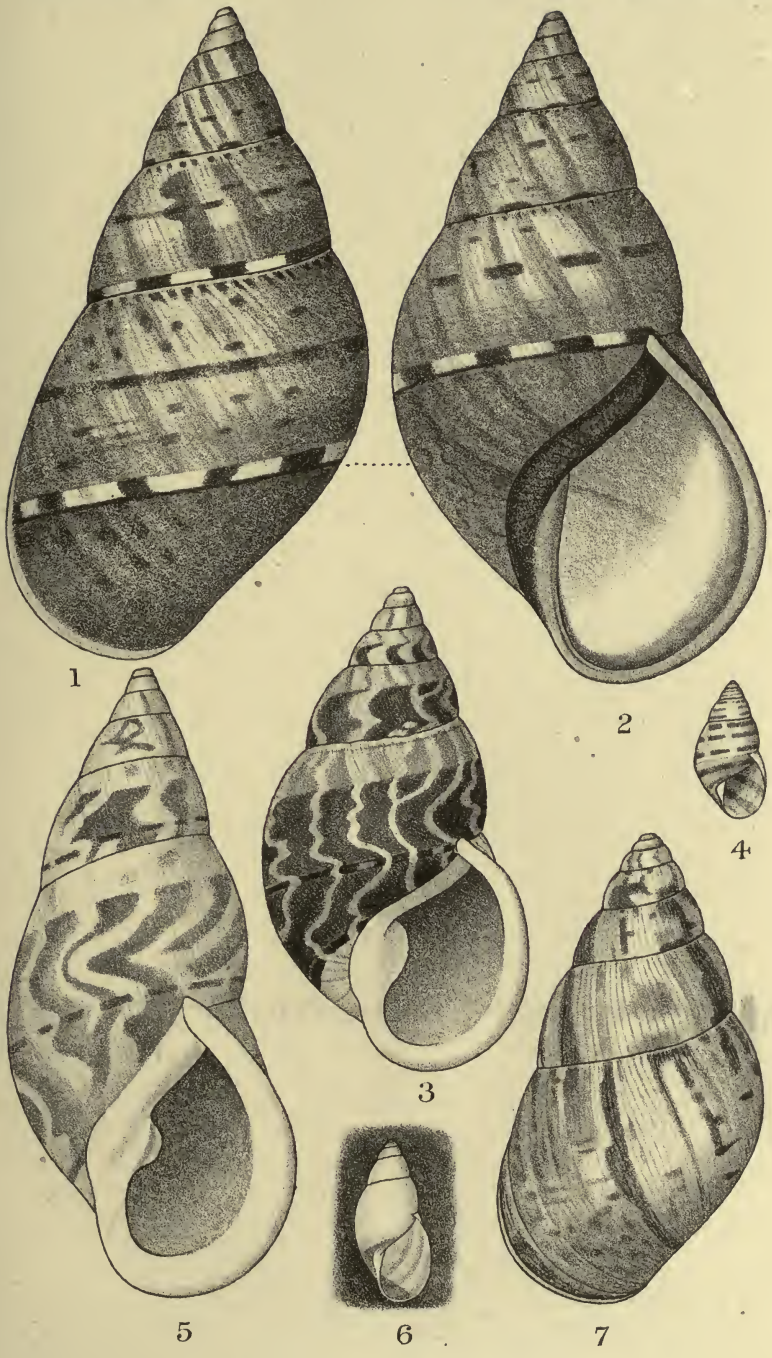

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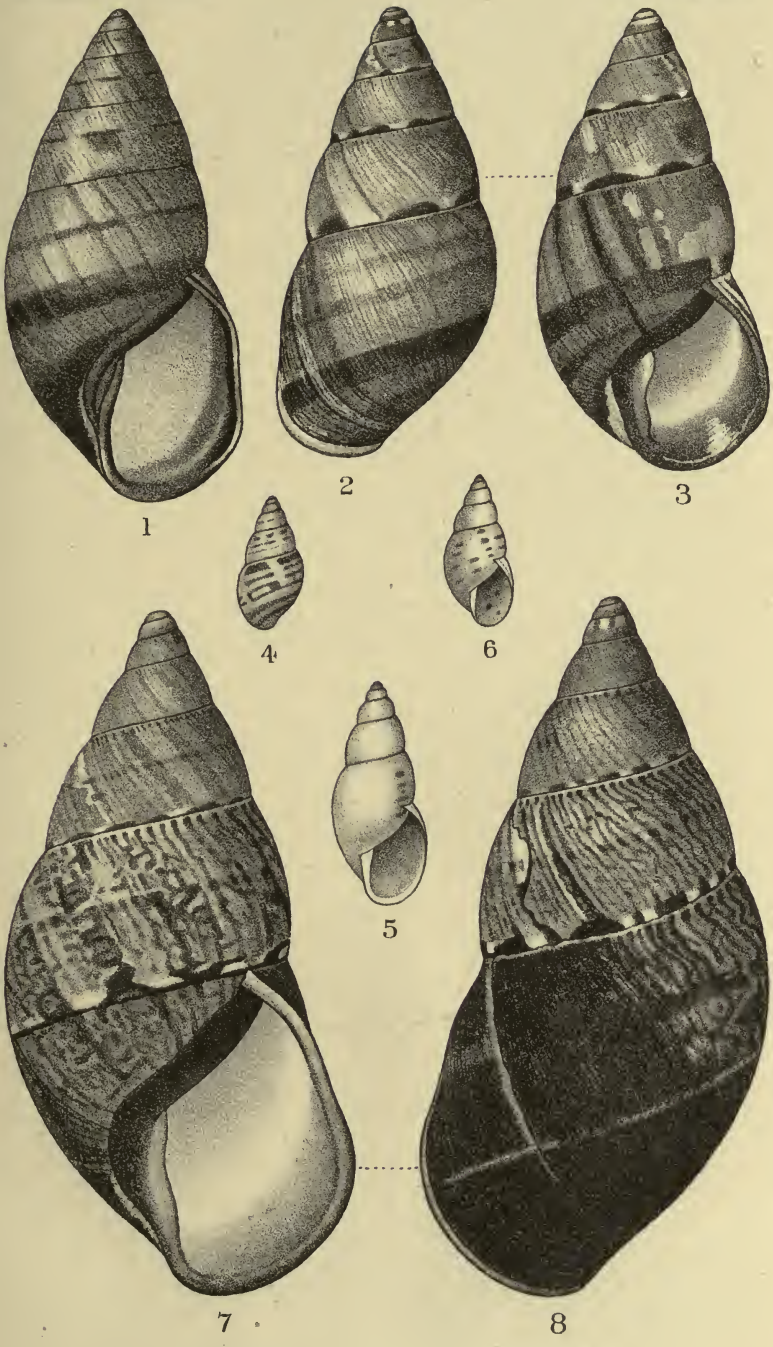
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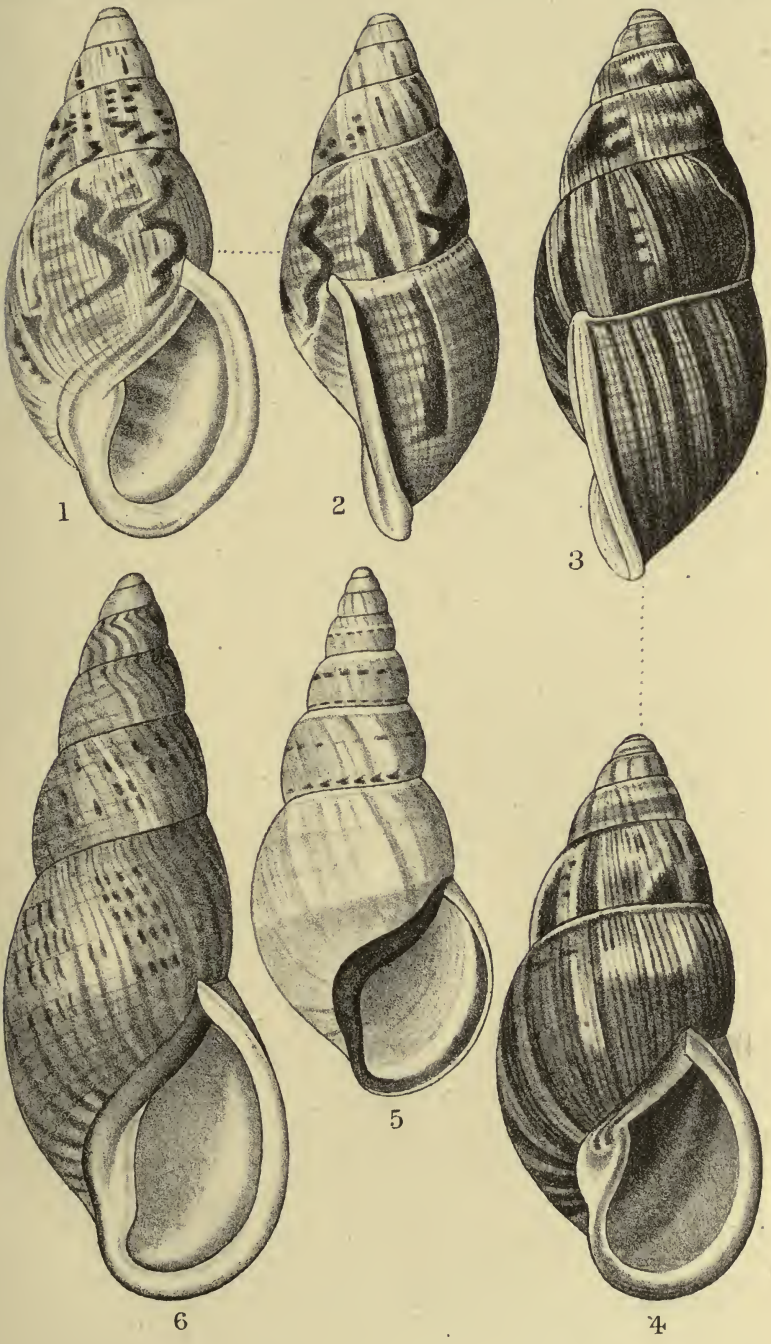
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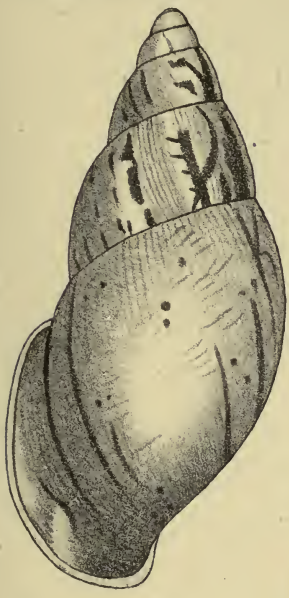

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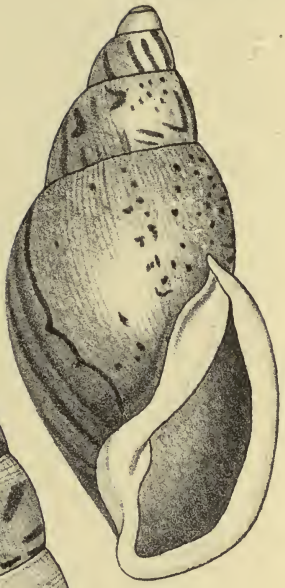

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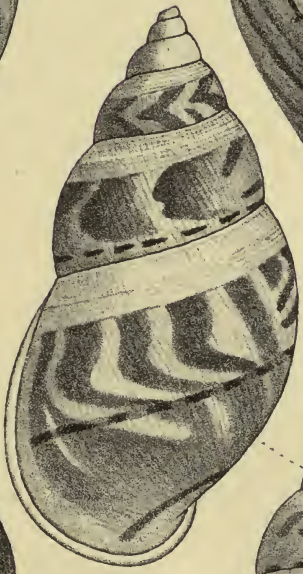

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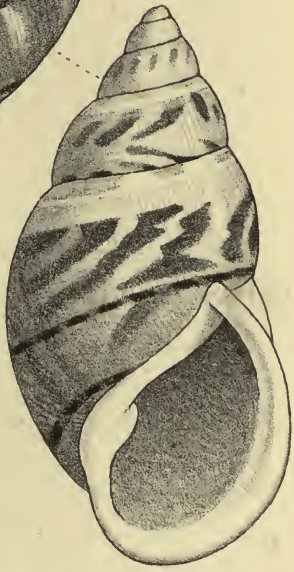

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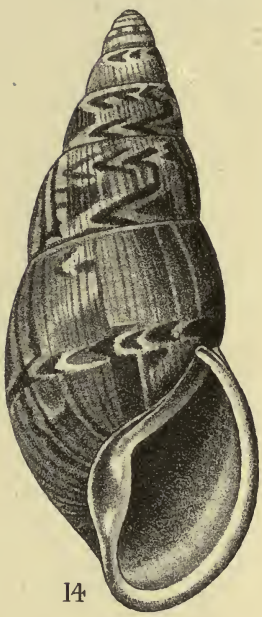

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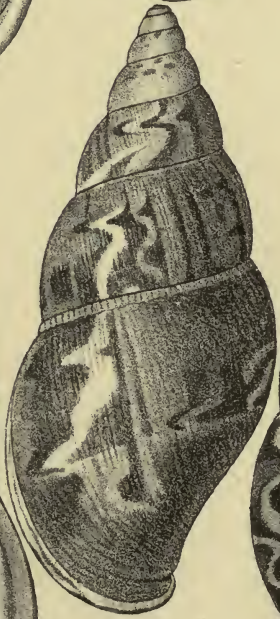

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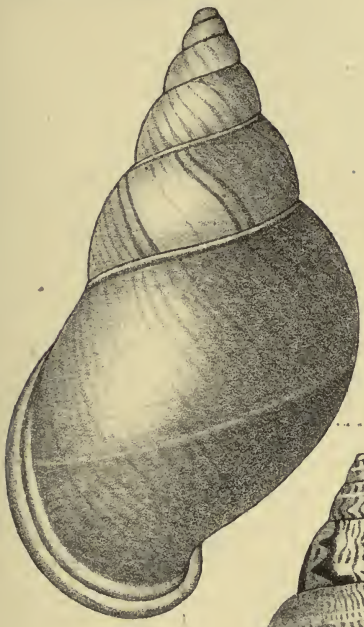

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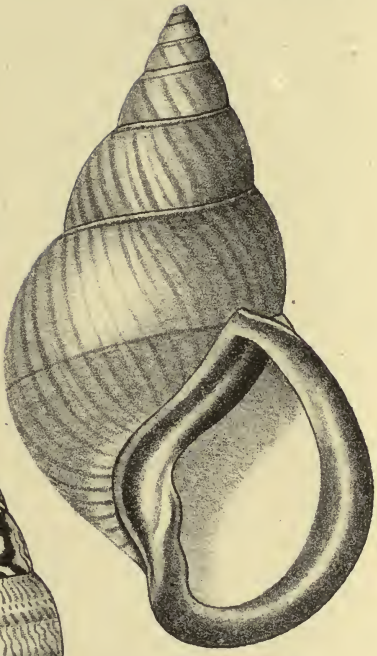

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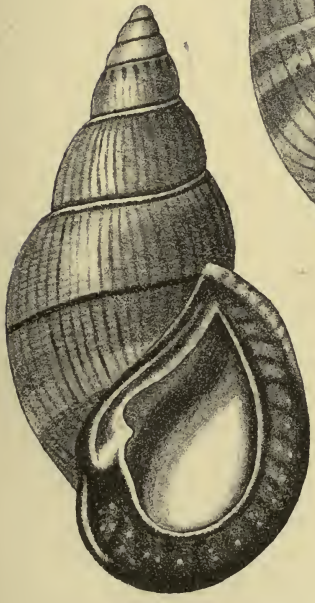

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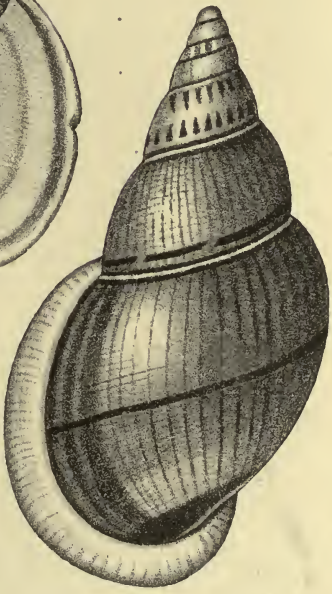

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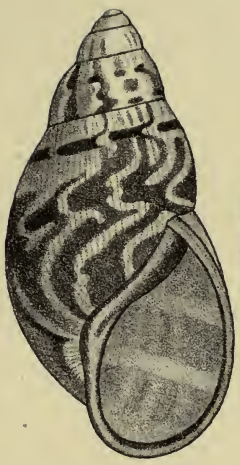

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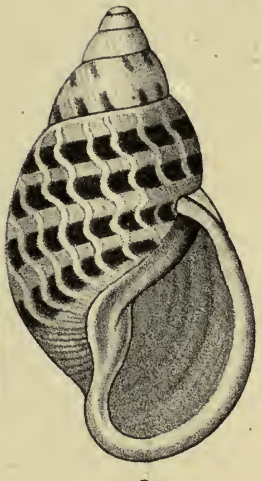

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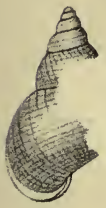

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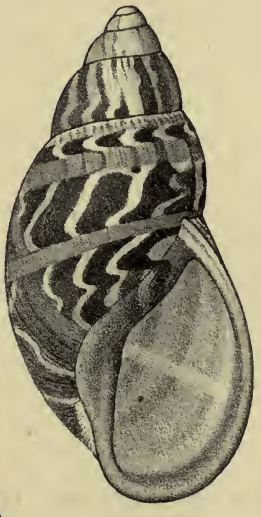

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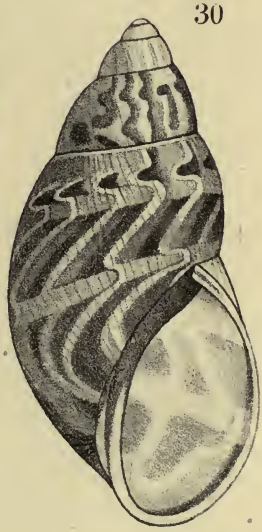

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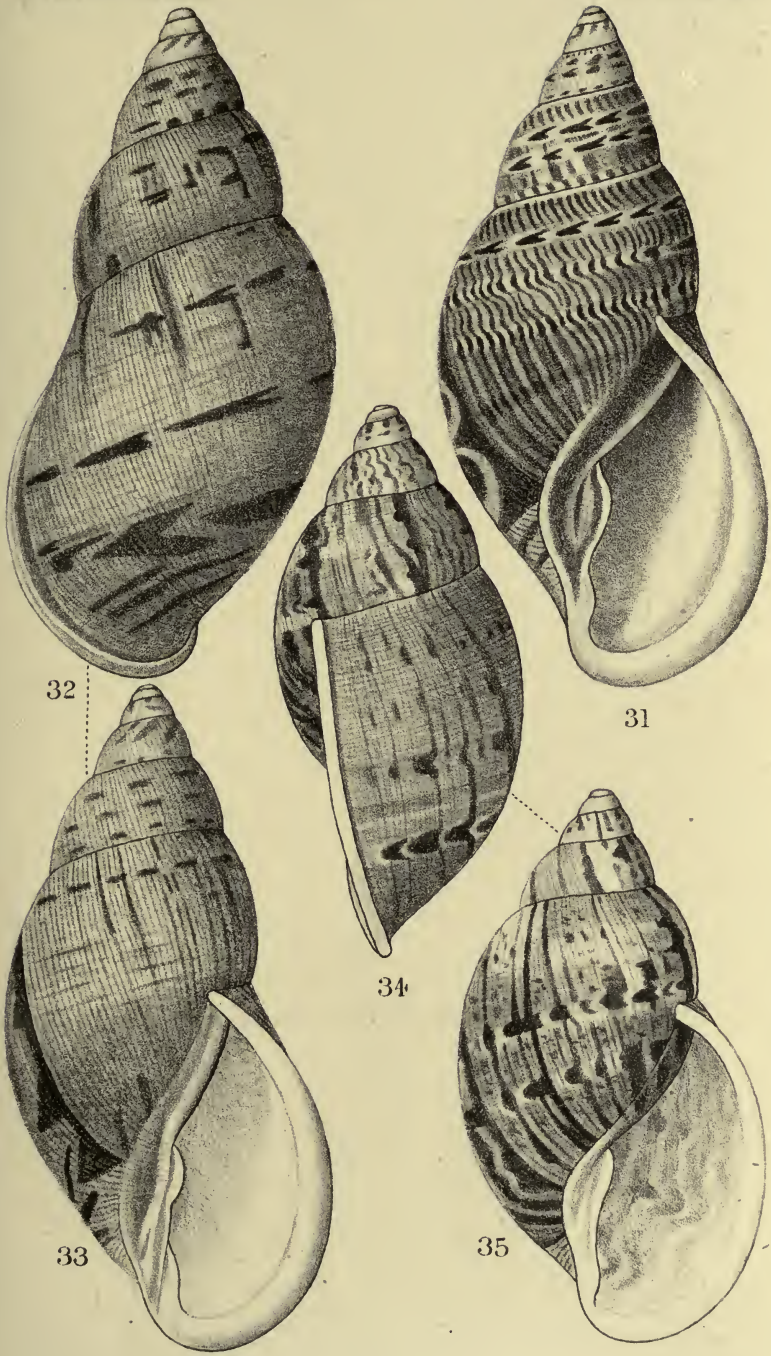
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*Key to Species of Corona.*

*a.* Outer lip black or blackish.

*b.* White within ; a peripheral band generally developed.

*c.* Dextral ; last half of the body-whorl blackish, spire pink. *regina*, p. 177.

*c*[1]. Sinistral, at least typically ; last half of the body-whorl not darker, the occasionally interrupted peripheral dark band giving place to a whitish one in some specimens ; ground-color flesh-tinted. *perversus*, p. 178.

*b*[1]. Purple within ; band in middle of upper surface of each whorl developed, short dark streaks between it and the suture ; sinistral. *incisus*, p. 179.

*a*[1]. Outer lip and interior white ; no well defined spiral bands in adults. Sinistral, or rarely dextral.

*b.* Last half of last whorl with yellow *or green* streaks. *regalis*, p. 180.

*b*[1]. Last half of last whorl black with orange spots. *regalis* var. *loroisianus*, p. 183.

L. REGINA (Férussac). Pl. 33, figs. 1, 2, 4, 5.

Shell *dextral*, oblong-turreted, thick and solid. *Spire pink*, with a median articulated band (sometimes faint or obsolete) and some rather wide, separated longitudinal streaks, brown on the upper, purplish on the penultimate whorl, upon which the *ground-color fades to the buff tint of the last whorl, where there is a variable number of narrow brown longitudinal lines ;* and the *latter half of the whorl usually becomes blackish olive, with some post-variceal snow-white stripes.* It is *begirt at the periphery by a black-brown band*, pale-edged, which may generally be seen as a series of arrow-spots nearly concealed by the suture, on the spire. Surface somewhat glossy, nearly smooth, growth-lines being but slightly developed. Whorls about 8, the apex usually self-amputated in large examples.

Aperture pure white within ; peristome with a narrow black-brown edge ; columella with a conspicuous callous fold above, obliquely truncated at base ; parietal wall and columella covered with a black callus, the fold of the columella fleshy white.

Alt. 86, diam. 35, longest axis of aperture 39 mill.

*Habitat unknown;* "*Brazil*" (in coll. Acad. Nat. Sci., with *L. regalis*).

*Helix* (*Cochlitoma*) *regina* Ferussac, Tabl. Systemat. p. 40, no. 342, based upon Histoire pl. 119 (exclusive of "*β*, minor," and "*monstrum, a* sinistra" (1823 ?).—*Achatina melastoma* Swainson, Zoölogical Illustrations iii, pl. 152 (excluding "var (reversed) *A. perversa*"), (1822–3).—*Achatina melanostoma* Sw., Gray, Annals of Philosophy (new series) ix, p. 414 (June, 1825).—*Orthalicus rex*, a. dextrorsus, Beck, Index Moll., p. 60 (1837).—*Achatina regina* Swains., Reeve, Conch. System ii, pl. 177, f. 8.—*Achatina regina* Fér., Pfr., Monogr. ii, p. 244 (*A.*, dextrorsa).

In any division of the *regina* group, either into species or varieties, the typical *regina* of Férussac must be restricted to his figures 3, 4, 5, of plate 119 of the *Histoire* (similar to the form shown in my pl. 33, figs. 1, 2). That he included a form "*β*, minor" (= *Oxystyla bensoni*) and a "monstrum, sinistra" (*Liguus perversus*) as pertaining to the species, is true; but obviously neither of these was regarded by him as typical.

Regardless of questions relating to the limits of the several varieties, typical *regina* is the large solid dextral form with pink spire and yellow-tinted body-whorl, upon which yellowish-olive streaks appear, at first separated, but upon the latter half of the whorl crowded and dark, or forming an almost uniform blackish-olive coat. Swainson's *A. melastoma* (pl. 33, figs. 4, 5) is a smaller specimen in which the longitudinal streaks are more developed upon the spire.

It is difficult to tell what form was collected by Lieutenant Eyriès near Cayenne, French Guiana; for while Drouet (Moll. terr. et d'eau douce Guyane Française, p. 67) refers to Férussac's figures 3–5, which represent the typical *regina*, yet he says that the peristome is white, and expressly states that he has not seen *melanostoma* Gray from French Guiana. The white peristome would also exclude *L. incisus*, which is reported from Guiana on Cuming's authority, and indicates the upper Amazon species, *L. regalis*.

L. perversus (Swainson). Pl. 36, figs. 20, 21, 22, 23.

Sinistral, oblong-conic, thick and solid. *Flesh-colored, with a black-brown belt at the periphery, occasionally interrupted, and overlying a slightly wider white belt*, which shows at the edges of the dark band, and where the latter is interrupted; a narrow black varix on the

last whorl; *several earlier whorls with wedge-shaped or irregular purplish longitudinal streaks.* Aperture white and thickened inside, the *lip with a black-brown edge and border within;* columella chestnut colored, short, with a particularly heavy and convex fold directed inwardly; the parietal callus black.

Alt. 61, diam. 29, longest axis of aperture 29½ mill.; whorls 7½.

*Demerara* (Jacobs, in R. Swift coll.).

*Achatinia perversa* Swainson, Zoölogical Illustrations i, pl. 36 (1820–21).—*Helix regina*, monstrum, sinistra, Férussac, Histoire, pl. 119, f. 6.—*Orthalicus rex*, b. sinistrorsus, Beck, Index Moll., p. 60 (1837).

*Bulimus regina* d'Orb., Hupe in Castelnau's Exped. dans l'Amer. du Sud, p. 33, pl. 10, f. 2; pl. 7, f. 1, 1*a*.

The blackish edge and internal border of the peristome, the shortness of the very convex and deeply situated columellar fold, and usual absence of basal truncation, the more pronounced effuseness or retraction of the base of the aperture, are all characteristic features of this form as contrasted with those following. The peripheral band and occasional black varices are also conspicuous, and with the bold longitudinal blotches and partial or complete obsolescence of a median articulated band on the whorls of the spire, usually permit ready recognition. In large specimens, however, the peripheral belt may become inconspicuous.

Hupé's "*Bulimus regina*" (pl. 36, figs. 24, 25) is apparently referable to this species as a dextral form, rather than to the typical *regina;* but it is not far from being a transition form between the two.

Swainson's name *perversa* was doubtless properly published before Férussac's *regina*, and was not pre-occupied; so that should the two be consolidated as the result of further investigations, *L. perversus* will take precedence. Swainson's type was a specimen almost exactly like my figs. 20, 21, 22 in size and coloration.

L. incisus (Hupé). Pl. 35, figs. 15, 16, 17.

Shell sinistral, elongate-turreted, irregularly wrinkled by longitudinal striæ; spire pyramidally acuminate, the apex obtuse; whorls somewhat convex; chestnut-brown, with longitudinal flexuous or angulated flammules, and an articulated band in the middle of the whorls of the spire, and when present, above the middle on the last

whorl. Aperture oblong, oblique, violaceous within, the inner margin deeply excavated in the middle; columella black, twisted, thickened, strongly truncate at base; outer lip simple, acute, bordered with blackish inside. Alt. 62, diam. 33 mill.

*Surinam, Demerara and British Guiana* (Cuming coll.); *Province of Bahia, Brazil* (Spix); *Provinces of Santa Cruz de la Sierra and Moxos, Bolivia* (Orb.); *Bolivia* (Hupé).

*Bulimus incisus* Hupé, in Castelnau, Exped. dans l'Amér. du Sud, Moll., p. 36, pl. 9, f. 1 (1857).—*Orthalicus incisus* Pfr., Monogr. vi, p. 202.—*Orthalicus melanostoma* Shuttleworth, Notitiæ Malacologicæ i, p. 67 (exclusive of references to Férussac).—Pfr., Monogr. iv, p. 591 (exclusive of references to Férussac, Swainson and Gray).—*Bulimus regina* Orb., Voy. dans l'Amér. Mérid., p. 258, pl. 29, f. 4 (living animal).—Reeve, Conch. Icon., pl. 27, f. 168*c*.—*Achatina melanostoma* Swains., Wagner in Spix, Testac. Bras., p. 16 (exclusive of synonymy), pl. 8, f. 1 = *Achatina perversa* Spix, l. c. (1827).

Shuttleworth's description under the name "*O. melanostoma*," is better than that of Hupé, from which the above is taken, especially in describing the coloration. "Purplish-flesh colored, becoming dull chestnut toward the base, with a median purple-brown band articulated with whitish, and a *series of short blackish-violaceous streaks between the band and the suture.*" "Columella callous, twisted, thickened above, blackish-chestnut or purple; *aperture semi-oval, purple deep within*, becoming whitish toward the margin; peristome unexpanded, *bordered with blackish-chestnut.*" He gives the dimensions, alt. 78, diam. 30, length of aperture 34 mill.

It resembles *L. perversus* in the dark-edged outer lip, but the aperture is purple inside instead of white, and the articulated band is not the peripheral (band 3 of the usual notation), as in *perversus*, but the one above that (band 2); above it, dark streaks run to the suture.

The dextral form doubtfully referred to this variety by Shuttleworth, and those cited by Pfeiffer, do not belong here.

L. regalis (Hupé). Pl. 35, figs. 13, 14, 19; pl. 34, figs. 9, 10, 11, 12; pl. 36*a*, figs. 26, 27 (specimens from Moyobamba); pl. 33, figs. 3, 6.

Shell usually sinistral, ovate or oblong conic, the surface varying from striatulate to plicatulate. Ground color various, but usually pale brown, or in denuded specimens, cream tinted,

the *cuticle becoming heavier and olivaceous-chestnut or decidedly green in streaks* on the latter half of the last whorl, where there are usually some ill-defined varices; the upper portion of the spire either flesh-pink or whitish; the markings consisting of some oblique brown streaks, and *a narrow median articulated band on the spire*, the band becoming obsolete on the last one or two whorls, which are variously figured with *wedge-shaped, light-bordered, purplish spots, or short lines transverse to the growth striæ*, or both; often with some irregular, longitudinal purplish streaks.

*Aperture white inside, the peristome white, without a dark border within;* columella with a prominent callous fold above, truncated below, brown, with more or less of the edge white; parietal wall and reflexed columellar callous black or nearly so.

Alt. 84, diam. 37, longest axis of aperture 39½ mill., whorls 8½.

Alt. 71, diam. 45, longest axis of aperture 36½ mill., whorls 7⅔.

Alt. 70, diam. 32, longest axis of aperture 35 mill.

Alt. 70, diam. 31, longest axis of aperture 33 mill., whorls 8⅓.

*Moyobamba Peru* (Moricand, Cuming, in R. Swift colln.); *Napo Ecuador* (Martinez); "*Brazil*" (Hupé in Castelnau).

*Bulimus regina* d'Orb., Reeve, Conch. Icon. v, pl. 27, f. 168*a*.

*Achatina regina* Fér., Pfr., Conchyl. Cab., p. 362 (in part), pl. 47, f. 1, 2.—*A. regina* Swains., Reeve, Conch. Syst. ii, p. 86, pl. 177, f. 7.

*Bulimus regalis* Hupe, in Castelnau, Exped. dans l'Amér. du Sud, Moll., p. 34, pl. 10, f. 3 (1857); cf. Pfr., Malak. Blätt. 1859, p. 49. —*Orthalicus regalis*, Pfr., Monogr. vi, p. 201.—*Orthalicus regina* Fér., Hidalgo, Journ. de Conchyl. 1870, p. 64; Moluscos del Viaje al Pacifico i, p. 134.—*Corona regina* Miller, Malak. Blätt. xxv, p. 185.—Cousin, Bull. Soc. Zoöl. France 1887, p. 193 (exclusive of most of the references and localities).

*Orthalicus* (*Corona*) *regina* Shuttleworth, Notitiæ Malacologicæ i, p. 66 (exclusive of part of references).—Pfr., Monogr. iv, p. 591 (excluding part of the references).

Distinguished from all the foregoing species of the group by its white peristome. There is no peripheral band on the adult shell; but the young, and often the spire of old specimens, shows an articulated or dotted band almost concealed at the suture. The markings consist of short lines or streaks transverse to the growth-striæ, with usually some wedge-shaped spots and longitudinal purplish streaks,

bordered with white on the right side, as though the pigment had been withheld a short time and then poured out copiously. Sometimes all of these markings are sub-obsolete, as in the chestnut-colored specimen shown in fig. 10 of plate 34. There is almost always more or less green in the cuticle on the latter part of the last whorl, though yellowish-chestnut occasionally replaces it.

Besides the pattern of coloring described above, more heavily striped shells occur (pl. 33, fig. 6), in which the occasional stripes of the ordinary form are emphasized and multiplied, are either straight or zigzag, and the shell is usually quite large. Fig. 7 of pl. 177 of the Conchologia Systematica, and fig. 168*a* of the Conchologia Iconica represent these richly colored specimens, and Dr. Hidalgo, in his excellent volume on the mollusks of the Spanish Expedition, has described similar individuals from Napo, Ecuador, collected by Sr. Martinez. As in the ordinary form, there is more or less green on the latter half of the last whorl.

Fig. 9 of plate 34 represents a rather small specimen, in which a reddish band, more or less obscured in places by the overlying cuticle, revolves above the periphery and just below the articulated dot-band of the spire; the earlier whorls have broad, angular, brown stripes; the first half whorl is reddish brown, the succeeding $1\frac{1}{2}$ whorls similar with a white crown. The last whorl is distinctly though obtusely angular in front, and is streaked with bright green cuticle, peculiarly spotted in places with white. This shell may be referable to the form *loroisianus*, but that seems to be only a weakly marked variety of *L. regalis*.

A young shell (pl. 35, fig. 19) has an articulated or dotted band at the rather acutely keeled periphery, another above the middle of the upper surface, and some light and dark streaks below the suture; just below the periphery there is a continuous dark chestnut band, and two more, separated by a cream-colored space with faint purplish streaks, are upon the base. The peripheral angle is hardly acute enough in the figure. D'Orbigny's pl. 29, fig. 5, shows a similar shell.

*Dextral form*, (pl. 36*a*, figs. 28, 29; pl. 33, fig. 3). Similar to the ordinary sinistral type, of which it probably is a mere form rather than a race. The specimens figured on pl. 36*a* are nearly denuded of cuticle, what remains showing the brownish or yellowish-green tint of the sinistral form.

Var. *loroisianus* (Hupé). Pl. 34, figs. 7, 8. Shell elongate-turreted, sinistral, with elevated, pyramidal-acuminated spire and obtuse apex; whorls 8; surface with very fine, close oblique striæ, apparent on the last whorl but hardly visible upon the earlier ones. Earlier whorls bright yellowish-rose colored, the tint deeper at the apex, traversed by a narrow brown or blackish articulated or interrupted band, which disappears on the last whorl; the latter is *blackish varied with spots and irregular longitudinal bands of orange-yellow*, formed by a ground of that color.

Aperture oblique, *white inside;* columella brilliant blackish, strongly twisted in the middle, and provided with a strong white callus extending to the base, with a slight truncation there. Alt. 64, diam. 30 mill.

*Between Lamas and Tarapoto, eastern Peru*, 300–400 meters above the sea (Stübel); *Juraty, middle Amazonas* (Dohrn).

*Bulimus loroisianus*, Hupe, in Castelnau, Exped. dans l'Amér. du Sud, Moll., p. 35, pl. 10, f. 1 (1857); cf. Pfr., Malak. Blätt. 1859, p. 50.—*Orthalicus loroisianus* Pfr., Monogr. vi, p. 202.—Dohrn, Jahrb. D. Malak. Ges. ix, 1882, p. 109.—*Orthalicus* (*Corona*) *melanostomus* Shuttl., var. *loroisianus*, Hupé, Martens, Conch. Mittheil. ii, p. 159.

The coloration of the last whorl, consisting of orange yellow spots scattered over a ground of intense black, seems to be the only character separating this form from *L. regalis*, while the blackness of the last whorl suggests *L. regina*, which differs in having the outer lip dark-bordered. I have not seen specimens.

Dr. Dohrn records *loroisianus* from "Juraty" (? Jutahy river, in western Brazil). Of fourteen specimens from this place examined by him, the largest reached a length of 68 mill. They almost agree in coloring, the upper whorls being fleshy-rose, then becoming whitish-yellow, the last whorl covered with an olive-colored cuticle, more or less rubbed off. The typical narrow dark band of the upper whorls is never wanting; generally there are similar streaks above or below, always interrupted. Dark stripes and flames are very irregular in occurrence, so that a few specimens appear especially dark. The aperture is milk-white within, columella and parietal wall glossy violet-black. The columellar fold shows great variability, sometimes being but little swollen, sometimes having thick callosities which on the edge bear one or two protuberances, this edge being

always whitish. The development of the columellar fold is independent of the more or less slender form of the shell. The lip-edge is white, only in young specimens, in which the lip had not attained its full thickness, the external epidermis shows darkly through. Only one of the lot is dextral. Four measure as follows:

Length 68, diam. 30, length of aperture 30, width 16 mill.
Length 56, diam. 32, length of aperture 27, width 17 mill.
Length 56, diam. 29, length of aperture 25, width 14 mill.
Length 53, diam. 32, length of aperture 25, width 16 mill.

LIGUUS, *sp. undet.* Pl. 35, fig. 18.

A young shell before me differs from all other young specimens of the group in being rounded at the periphery, without trace of a keel. Whorls $6\frac{1}{2}$; there is no articulated band in the middle of the whorls of the spire, but one shows at the sutures, and a narrow continuous purple-brown band bordered with cream-tint above, encircles the periphery, becoming obsolete on the latter part of the whorl; another narrow band is upon the base. As the young of *regina*, *regalis* and *incisus* seem to be keeled, I am at a loss to tell where this shell belongs. The locality, "Amazon," may not be reliable.

## Subgenus HEMIBULIMUS von Martens, 1885.

*Hemibulimus* v. MART., Conchologische Mittheilungen, ii, p. 175.

Shell rather fusiform, sculptured and dark colored; aperture about half the length of shell, the outer margin of peristome unexpanded and obtuse, columellar margin deeply concave, the columella distinctly truncated at its base. Apex obtuse, the first whorl finely wrinkled.

Jaw composed of 13 imbricating plates, the median one reaching to the lower margin. Radula with the central and inner two lateral teeth on each side helicid in form, with long lanceolate mesocones and slight rudiments of ectocones; the other teeth as in *Orthalicinæ* generally.

Type, *Liguus excisus* Martens = *Achatina magnifica* Pfr.

The shell resembles *Liguus* in its *Achatina*-like columella, but differs in the sculpture of the apex as well as of the rest of the shell, and the dark coloration,—characters assimilating it with *Orthalicus*. The radula resembles *Liguus virgineus* and *Orthalicus gallinasultana* in the lanceolate cusps of the median teeth. Similarly shaped teeth

have been shown by Strebel and Pfeffer to occur also in certain Mexican forms of *Oxystyla*.

L. MAGNIFICUS (Pfeiffer). Pl. 36*a*, figs. 30, 31, 32, 33, 34.

Shell ovate-subfusiform, rather thin, lightly striatulate, hardly shining; buff, variegated with green and chestnut flames, and one supramedian band, articulated buff and chestnut. Spire conic, the apex very obtuse; whorls $5\frac{1}{2}$, scarcely convex, the last a little longer than the spire; suture narrowly margined. Columella straight, vertical, covered with a callus which is white inwardly, blackish outwardly, base red, obliquely truncated at the base of the elliptical aperture, which is blue-white inside. Alt. 47, diam. 21, length of aperture 27 mill. (*Pfr.*)

*Quito, Ecuador* (Delattre); *Southern Colombia*, in damp forests (Lehmann).

*Achatina magnifica* PFR., P. Z. S. 1847, p. 232; Monogr. Hel. Vivent. ii, p. 255; iii, 487; iv, 602; vi, 217.—REEVE, Conch. Icon. v, *Achatina*, pl. 9, f. 33.—DUNKER, Jahrb. d. D. Malak. Ges. ix, 1882, p. 380.—COUSIN, Fauna Malacol. de la. Rép. de l'Equateur (p. 45 of separate copies), in Bull. Soc. Zoöl. France, 1887, p. 231.

This species has been described more in detail by Dr. von Martens, as *Liguus excisus*. There are some differences in coloration, and possibly *excisus* may be a local race rather than an absolute synonym. Fig. 30 represents Pfeiffer's type.

*L. excisus* von Martens. (Pl. 36*a*, figs. 31–34.) Shell ovate fusiform, imperforate, irregularly striate and malleolate, decussated by some spiral lines (fig. 33); brownish-green, painted with some brown and buff streaks. Whorls 6, regularly increasing, the suture appressed, whitish, somewhat crenulated; apex obtuse, with an axial dimple, first whorl minutely granulose, the whole almost black, the following three whorls more reddish, with a blackish, white-spotted, sutural zone.

Aperture but slightly exceeding half the length of the shell, ample, acutely angular above; outer lip unexpanded, obtuse, narrowly scarlet-edged, with a blackish border within; columellar margin deeply concave, strongly truncated below, as in *Achatina*, and scarlet colored, passing into the outer lip by a short, narrow basal sinus; the parietal wall covered with a glossy black-brown deposit.

Alt. 44, greater diam. 22, lesser 18, length of aperture 23, width 13 mill. (*Martens*).

*Popayan, Colombia*, in the cold, elevated region, about 2400 meters above the sea (Dr. A. Stübel).

*Liguus* (*Hemibulimus*) *excisus* v. MART., Conchol. Mittheil. ii, pp. 173, 160, pl. 35, f. 1, 2, 4, 5 (shell).—*Liguus excisus* SCHACKO, *t.c.*, p. 200, pl. 36, f. 1–4 (jaw and teeth).—*Hemibulimus magnificus* Pfr. v. MART. Nachträgliche Bemerkung, *t. c.* (Nov. 21, 1885).

## Genus ORTHALICUS Beck, 1837.

*Orthalicus* Beck (in part), Index Molluscorum, p. 59 (for *O. sultan* B., *zigzag* Lam., *princeps* Brod., *pulchellus* Spix, *undatus* Brug., *zebra* Müll., *livens* B., *phlogerus* Orl., *adamsoni* Gray, B., *rex* B.).—TROSCHEL, Zeitschr. f. Malak. 1847, p. 50, footnote; Archiv f. Naturg. 1849, i. p. 228, as a genus for *B. gallinasultana*.—VON MARTENS in Albers, Die Hel., edit. 2, p. 171, type *O. zebra* Müll.—*Orthalicus* § *Sultana* SHUTTLEWORTH, Notitiae Malac. i, p. 58 (1856).—*Orthaliscus* Beck, GRAY, P. Z. S. 1847, p. 176, type *Helix sultana*.

Shell imperforate, varying from ovate to oblong-conic, thin or solid, with *the nepionic shell composed of 2½ to 3½ densely thimble-pitted whorls*, the subsequent whorls either decussated or merely striate. Aperture ovate, with the péristome either thin and simple, or thick, expanded or broadly reflexed.

Jaw and dentition similar to those of *Oxystyla*, or with the teeth of the median part of the radula bearing longer, pointed cusps; the penis (in *O. sultana*) with a mere swelling in place of of the lobed accessory gland or appendix of *Oxystyla*.

Type, *Helix sultana* Dillw. Distribution, tropical and subtropical South America, especially in the Andean region.

*Orthalicus* was founded by Beck for a group of tropical American snails previously described as *Bulimi*. While the "remarkable conchological instinct" of Beck enabled him to accurately assign the species then known to his new group, it was practically ignored by his co-laborers until Troschel, in 1847–8, announced that the genus had strongly marked anatomical characters, which caused him to adopt it for the *B. gallina-sultana*, which he had dissected. About the same time, Gray, in his list of molluscan genera with their types (P. Z. S. 1847), nominated "*Helix sultana*" as type of the genus, the name of which he misspells "*Orthaliscus*." These two authors by

selecting the same species, clearly fix the type of Beck's genus; although Herrmannsen a year or two later gives *B. zebra* Müll., as type of the group, a decision accepted by Dr. von Martens in 1860, and by some later authors.

Shuttleworth, in 1852, published a monograph of the genus, which like all of his conchological work is a model of lucid reasoning; and this work established most of the species then known upon a firm basis so far as their synonymy was concerned. He divided Orthalicus into three sections: SULTANA for *O. gallina-sultana* and its allies, ZEBRA for the *undatus* group, and CORONA for the *regina* group. Further, he proposed a subgenus, PORPHYROBAPHE, for the species with thickened or reflexed lip. These divisions have been retained by authors generally up to this time. MM. Crosse and Fischer, in discussing the genus in their volume on land mollusks in the "Mission Scientifique au Mexique," take occasion to review the classification, endorsing Shuttleworth's conclusions. Finally Herr Strebel has offered some suggestions of value for the improvement of Shuttleworth's classification, in that veritable mine of observation and original suggestion, the "Beitrag zur Kenntniss der Fauna Mexikanischer Land- und Süsswasser-Conchylien." His chief modification is in proposing the definite separation of the *Porphyrobaphe* species with pitted, from those with smooth, nuclear whorls.

*Key to groups of Orthalicus.*

*a*. Shell thin, capacious, with oblique large aperture and simple and thin or somewhat thickened lip and columella, the former unexpanded. Section ORTHALICUS *s. str.* (see below, p. 188.)

*a*[1]. Shell solid, more lengthened, the aperture smaller, but slightly oblique or vertical, the lip thickened and blunt, or expanded or reflexed; columella usually with one or two folds. Section METORTHALICUS Pilsbry.

*b*. Shell very solid, with the lip thick, expanded or not, somewhat purple or broadly purple-bordered within. Colombian. *Group of O. atramentarius*, p. 205.

*b*[1]. No purple border within the lip, and without the above combination of characters. Species of Ecuador and Peru.

*c*. Shell spirally striated; peristome white or pale.

*d*. Spaced, rather strong spiral lines or furrows,

visible to the naked eye; lip well expanded or reflexed, white or light colored.

*Group of O. fraseri*, p. 192.

$d^1$. Spiral striæ fine and close, the shell rather smooth; lip and entire aperture pure white, the former expanded or reflexed; columella with a strong fold above.

*Group of O. deburghiæ*, p. 196.

$c^1$. No spiral striation; peristome colored.

*Group of O. labeo*, p. 199.

Subgenus ORTHALICUS (restricted).

The selection of *H. sultana* Dillw. (*gallina-sultana* auct.), as typical of *Orthalicus* by Gray and Troschel, restricts that group to a few large, richly variegated shells inhabiting the Guianas, western Peru and central and northern Bolivia—all abundantly watered forest regions. The exact definition of the species and varieties awaits fuller knowledge of their geographic distribution, which in large part still remains to be mapped.

O. SULTANA (Dillwyn). Pl. 47, figs. 6, 7, 8.

Shell large, ovate, with rather short, conic spire and ventricose last whorl; thin; immature specimens more or less fragile. Last whorl buff, closely veined with irregular and anastomosing, or festooned purplish or brown stripes, and encircled by three principal blackish-purple or brownish-purple spiral bands irregularly interrupted by white or creamy spots or stripes; narrower or indistinct bands in the intervals between the main ones (a variety with five bands); the upper band usually formed of a broad series of large dark alternating with light (or white) blotches; the spire closely marked with festooned stripes and two or three spot-girdles or bands of angulation. Surface lustreless, finely plicatulate obliquely, decussated by close spiral striæ, at narrow intervals stronger. Whorls 6, moderately convex, the first $2\frac{1}{2}$ forming the densely thimble-punctate obtuse nepionic shell, the earliest two whorls dark brown above; last whorl very large; suture not deflexed anteriorly.

Aperture large, oblique, ovate, bluish white (lilac colored in a variety) and variously mottled within; peristome thin, unexpanded, light brown (or in a variety, black-brown in adults, with a rather wide internal border of the same color, fading through purple into

white); columella thin, arcuate, white (in a variety nearly straight and whitish above only); parietal wall with a brownish callus, usually white within (but in the variety with a broad blackish-chestnut callus throughout), wanting in young shells.

Alt. 84, diam. 54, longest axis of aperture 56 mill. (var.)

Alt. 53, diam. 39, longest axis of aperture 38 mill.

Alt. 70, diam. 50 mill.

*La Poule Sultane*, FAVANNE, Cat. Syst. p. 13, pl. 1, f. 47.—*Helix gallina sultana* CHEMNITZ, Conchyl. Cab. xi, p. 281, pl. 210, f. 2070, 2071 (1795).—*Bulimus gallinasultana* LAM., An. s. Vert. vi, p. 117 (1822)—WAGNER, in Spix, Testac. Bras. p. 9.—ORBIGNY, Voy. dans l'Amér. Mérid. p. 265.—REEVE, Conch. Syst. ii, pl. 173, f. 7; Conch. Icon. pl. 32, f. 198.—KÜSTER, Conchyl. Cab. p. 8, pl. 8, f. 1, 2.—TROSCHEL, Archiv für Naturg. 1849, i, p. 228, pl. 4, f. 2 (dentition); Reisen in Britisch-Guiana (Schomburgh), iii, p. 547.—HUPE in Castelnau, Exped., p. 38 (1857).—DROUET, Moll. Terr. et Fluv. Guyane Francaise, p. 66 (1859).—PFR., Monogr. ii, p. 145; iii, 381.—*Succinea gallina-sultana* PFR., Symbolæ ad Hist. Hel., ii, p. 131 (1841).—*Orthalicus gallinasultana* SHUTTLEWORTH, Notitiæ Malac. i, p. 59 (1856.)—PFR., Monogr. iv, p. 587; vi, p. 198, viii, p. 261.—BINNEY, Ann. Lyc. Nat. Hist. of N. Y. xi. (1874), p. 38, pl. 4, f. A-F(anatomy); Ann. N. Y. Acad. Sci. iii (1884), p. 128, pl. xv, f. N (jaw), pl. xii., f. C (dentition).—STREBEL, Beitr. Mex. Land- und Süsswasser-Conch. v. p. 2, pl. xi, f, 10 (genitalia).—MARTENS, Conchol. Mittheil., p. 158.—*Sultana gallina sultana* MILLER, Malak. Blätt. xxv, p. 186.—COUSIN, Bull. Soc. Zoöl. de France, xii, 1887, p. 196.

*Helix sultana*, DILLWYN, Descriptive Catal., ii, p. 920 (1817).—FÉR., Prodr., p. 52; Histoire, pl. 117, f. 2.—WOOD, Index Testaceologicus, pl. 33, f. 75.—ORBIGNY, Mag. de Zoöl. 1835, p. 8.—*Achatina sultana* SWAINS., Exotic Conchology, p. 26, pl. 10 (1841).—*Orthalicus sultan* BECK, Index Moll., p. 59 (1837).—*Achatina pavonina* SPIX, Testac. Bras., pl. 9, f. 1 (1827).—*Bulimus princeps* POTIEZ & MICHAUD, Galerie des Moll., i, p. 151, pl. 14, f. 29.—*Orthalicus gallinasultana* and *O. pavoninus* H. & A. AD., Gen. Rec. Moll., ii, p. 154.

The Guianas: *All over British Guiana*, on tree trunks (Schomburgk); *around Cayenne, French Guiana* (Eyries). N.-E. Brazil: *on the Rio Tocantins, in the region of Baiao*, 5 meters above the sea

(Stübel). Peru: *Marañon* (Orton). Bolivia: *Middle of the republic*, and near the *Mission of Bibosi*, 20 leagues from Santa Cruz de la Sierra (Orbigny).

The thin lip and columella distinguish this species from the *O. trullisatus*. The typical form (figs. 6, 7) is from the Guianas, where it is a widely-distributed and common shell. The specimens from the upper Amazon drainage belong to a more oblong, darker colored race, noticed below. It is a magnificent snail, formerly very rare; Férussac is said to have paid 560 francs for his specimen, at the sale of the Count de Latour d'Auvergne.

It is usually known as *O. gallinasultana*, Chemnitz, variously written as one word, compounded with a hyphen, or as two words, the latter being Chemnitz's mode. It was not originally a binomial name, and even those who accept it do not extend their liberality to other trinomials in the same volume of Chemnitz. The first binomial name is that of Dillwyn.

D'Orbigny distinguished two varieties: the typical form of Guiana, which is shorter, more ventricose, and another discovered by him in Bolivia, which is more elongated, larger, with five spiral zones and black-bordered peristome. This race (pl. 47, fig. 8) which may be what Pfeifer called B. meobambensis, was met with by d'Orbigny in the great humid forests of mid Bolivia, inhabited by the wild tribe of Guarayos. It remains deeply buried at the feet of the trees, coming forth upon the trunks of trees only in the rainy season, when only it may be procured. He gives the size as 80 mill. long, 45 wide. It is apparently what Herr Stübel collected on the Rio Tocantins, described by Dr. von Martens as follows: It "is somewhat more slender than the usual form from Guiana and Surinam, the outer lip with a narrow, distinctly defined black-brown border inside, parietal wall black-brown throughout, the upper half of the columellar margin white, lower half dark brown. Length 73, diam. 48, height of aperture 48, breadth 30 mill. Approaches *O. trullisatus* Shuttl., but the columellar margin is thin and concavely arched, as in *O. gallina sultana*."

Beck attempts to distinguish two varieties: a, *cayanensis*, based upon the figure given by Spix, the locality of which is unknown, and b, *bolivianus*, based upon Chemnitz's figures (which are the basis of typical *sultana*), and those of Férussac. The latter represents a Guiana shell. It would seem that these two varietal names must fall as pure synonyms of typical *O. sultana*.

O. MEOBAMBENSIS (Pfeiffer).

Shell imperforate, ovate-conic, rather solid, closely striated, and somewhat granulated by spiral striæ; green-whitish, with interrupted black bands combined with waved streaks, and above the middle with large, angular, black spots. Spire conic, obtuse; whorls $6\frac{1}{2}$, a little convex, the last five-eighths the total length, ventricose, sometimes bearing varices. Columella compressed, white-calloused, straightened and receding.

Aperture oblique, angulate-oval, pearly within, the peristome black-margined, a trifle expanded, margins connected by a blackish-chestnut callus. Alt. 88, diam. 46 mill; aperture 55 mill. long, 33 wide (*Pfr.*).

*Moyobamba, Peru* (Yates, in Cuming coll.)

*Bulimus meobambensis* PFR., P. Z. S., 1855, p. 96 (printed July 23, 1855, see P. Z. S., 1893, p. 439).—*Bulimus gallinasultana* β, PFR., Monogr. iii, p. 381.—*Orthalicus meobambensis* PFR., Monogr. iv, p. 586.—*O. moyobambensis*, MART. in Albers' Die Hel., edit. 2, p. 225.

"Differs from *O. gallinasultana* in the oblong form, more solid texture, more convex whorls and straight columella" (*Pfr*).

Pfeiffer, in the Monographia, places *O. trullisatus* as a synonym under *meobambensis*. From the description, translated above, I would think *meobambensis* identical with the upper Amazonian variety of *O. sultana*. As I am unable to decide the question, the original descriptions are given.

O. TRULLISATUS Shuttleworth. Pl. 47, figs. 9, 10, 11.

Shell ovate-acuminate, rather thin, very closely rugose-striate, decussated with remote impressed spiral lines and others very close, granulose and somewhat undulating (fig. 10); scarcely shining, dull greenish buff, encircled with five purple-black bands articulated with white, with scattered narrow brown streaks, broad, ragged, blackish-purple blotches, and whitish spots. Spire conic, nuclear apex banded with black-brown and pitted (fig. 9); suture moderate; whorls $6\frac{1}{2}$, a little convex, the upper ones purplish, conspicuously streaked, the last nearly twice the length of the spire, rounded at base. Columella a little straightened, callously thickened, black-brown, obliquely subtruncate at base. Aperture a little oblique, oblong-oval, opaque milky inside; peristome somewhat duplicated,

unexpanded, broadly bordered inside with a blackish-purple callus; the margins joined by a somewhat thick black-brown callus, strongly thickened outside at the base of the columella. Alt. 90, diam. 52, length of aperture 53, width 33 mill. (*Shuttl.*)

*Tarapoto, Eastern Peru* (Moricand).

*Orthalicus trullisatus* SHUTTL., Notitiæ Malacologicæ i, p. 58 (exclusive of synonymy), pl. 5, f. 1 (1856).

Intermediate between *O. gallina-sultana* and *O. dennisoni;* differing from *O. dennisoni* in the thinner, more inflated shell with more convex whorls, the blackish-purple bands, and color of the aperture and columella; from *O. gallina-sultana* it differs in the more solid shell, which is opaque and more slender, in the thickened black-brown columella, and color of the aperture and peristome (*Shuttl.*).

### Subgenus METORTHALICUS Pilsbry, 1899.

*Porphyrobaphe*, in part, of Shuttleworth and other authors. *Bulinus*, BRODERIP, Zoölogical Journal iv, p. 222 (1828), not of O. F. Müller, 1781.

This new group includes species with pitted nepionic whorls as in typical *Orthalicus*, but differing in the solidity of the shell and its thick, blunt or reflexed lip.

### GROUP OF O. FRASERI.

The species placed here are related to typical *Orthalicus* in coloration and sculpture, differing in the less ventricose form, and developed peristome. *O. galactostoma* and *O. augusti* are stated to have smooth apical whorls; and if this proves to be true, they must be removed to *Porphyrobaphe.*

*Key to species.*

*a.* Columella with a rather strong fold above; aperture more than half the length of the shell; having bands of blackish spots or streaks.

*b.* Aperture purplish-fleshy within. *fraseri*, p. 193.

*b*[1]. Aperture and peristome milk-white, columella making an angle with the basal lip. *galactostoma*, p. 194.

*a*[1]. Columella not folded above, but twisted below; aperture less than half the length of shell, of a deep livid rose color, the lip whitish; shell very long, alt. 93, diam. 36, aperture 37 mill. *buckleyi*, p. 193.

$a^2$. Columella without noticeable folds; aperture exceeding half the length of shell. *augusti*, p. 195.

O. BUCKLEYI Higgins. Pl. 41, fig. 6.

Shell imperforate, oblong-conic, solid: sculptured with irregular longitudiual rugose costae and close, irregular, deeply impressed spiral lines. Fleshy-rubescent under a yellowish-tawny epidermis. Longitudinally ornamented with reddish-brown streaks.

Spire conic, the apex obtuse, suture whitish. Whorls 7, a little convex, the first two minutely granulose-striate, the last nearly equal to the spire, tapering at base. Columella thick, twisted at base, flesh colored. Aperture subvertical, acuminate-oblong, of a deep roseate livid color inside; peristome thickened, expanded, narrowly reflexed, whitish outside, the margins joined by a thin glossy callus. Alt. 93, diam. 36, length of aperture 37, width 17 mill. (*Higgins*).

*San Lucas, Ecuador* (Buckley).

*Orthalicus* (*Porphyrobapha*) *buckleyi* HIGGINS, P. Z. S. 1872, p. 685, pl. 56, f. 3.—*Bulimus buckleyi* (*Orthalicus*) PFR., Monogr. viii, p. 21.—*Porphyrobaphe buckleyi* MILLER, Malak. Blätt. xxv, p. 185. —COUSIN, Bull. Soc. Zoöl. France xii, p. 200.

No additional information is given by the authors mentioning this remarkable species subsequent to Higgins.

O. FRASERI (Pfeiffer). Pl. 46, figs. 31–35.

Shell imperforate, oblong-fusiform, solid, longitudinally closely striated and encircled by remote impressed lines. Flesh-colored under a lusterless greenish-tawny epidermis, ornamented with interrupted bands of arrow-shaped black-brown marks, or confluent into lightning-streaks. Spire conic, the apex rather obtuse, whorls 6, a little convex, the last about the length of the spire, tapering at base; columella violaceous, provided with a strong fold above, somewhat twisted below.

Aperture very oblique, semi-elliptical, subangular at base, milk-white inside, peristome roseate, thickened and expanded, the margins joined by an entering, glossy lilac tinted callus; columellar margin narrow, adnate. (*Pfr.*).

Alt. 89, diam. 37, length of aperture with peristome 49 mill. (*Pfr.*).

*Ecuador: Province of Cuenca* (Fraser, in Cuming coll.); *Railroad of Quito, 30 or 40 kilometers from Chimborazo.* (Paz.)

*Bulimus fraseri* Pfr., Malak. Blätter, v, 1858, p. 239; P. Z. S. 1860, p. 137, pl. 51, f. 5; Novit. Conch. p. 157, pl. 42, f. 1, 2; Monogr. vi, p. 15.—Hidalgo, Journ. de Conchyl. 1870, p. 44.—*Porphyrobaphe fraseri* Pfr., Miller, Malak. Bl. xxv, 185.—Cousin, Bull. Soc. Zoöl. France xii, p. 200.—Dohrn, Jahrb. d. D. Malak. Ges., ix, 1882, p. 114.

Dohrn remarks that the coloration of his specimens is variable; the upper whorls have a subsutural band of white and dark brown spots; the shells are smaller than Cuming's, though of the same form and sculpture, measuring:

Alt. 73, diam. 33, length of aperture 43, width 27 mill.

Alt. 67, diam. 30, length of aperture 41, width 22 mill.

Alt. 60, diam. 25, length of aperture 36, width 20 mill.

Pfeiffer's type (fig. 31) and the specimen figured in the *Novitates* (figs. 32, 33), are decidedly more lengthened than the only one I have seen, which probably represents a race or variety.

Var. brevispira, n. v. (pl. 46, figs. 34, 35). Decidedly shorter than typical *fraseri*, with larger aperture; surface decussated with close spiral grooves; $2\frac{1}{2}$ nepionic whorls thimble-pitted, distinctly demarked from the post-natal growth; whorls of the spire with occasional angular blackish stripes and fine brown wavy streaks, the last whorl with four girdles of blackish arrow-spots and some black streaks, on a ground of brown-stained, somewhat olivaceous yellow, becoming duskier and reddish below; lip obtuse, thick, expanded, reflexed below, white; columella purplish with white folds, the parietal callus transparent, lilac tinted. Alt. 69, diam. 38, longest axis of aperture $44\frac{1}{2}$ mill.

O. galactostoma (Ancey). *Unfigured.*

Shell imperforate, ovate, solid; whitish under a buff, but little shining epidermis, irregularly marked with spots and interrupted streaks, brownish above, brown greenish on the last whorl, and arranged in four rather wide, indistinct transverse stripes. Spire conoid-attenuated, rather short, obtuse; whorls 6, rapidly increasing, convex; suture irregular, slightly crenulated; embryonic whorls smooth, the following ones delicately granulated, the lower whorls obliquely grooved with impressed growth-striæ and

decussated by remote spiral lines, last whorl oblong, attenuated, ample.

Aperture large, ovate, angulated above, tapering below and with the peristome milk-white within, showing the spots; moderately oblique, slightly receding below; columella acutely folded above, thickened, white, becoming nearly straight, tapering below, forming a distinct angle with the basal lip; margins joined by a glossy whitish callus; peristome thickened, expanded, umbilical region narrowly marked with brown. (*Ancey.*)

Alt. 72, diam. 34, alt. of aperture 40 mill. *Ecuador.*

*Porphyrobaphe galactostoma*, Ancey, Bull. Soc. Malac. France, vii, p. 153 (1890).

Akin to *Porph. fraseri* Pfr. and especially *Porph. cousini* Jouss., but differing from both chiefly in the color, especially of the aperture, and the characters of the columella. (*Ancey.*)

An unfigured species, apparently more slender than *fraseri*, with shorter mouth. Ancey apparently intends *P. augusti* by his reference to "*Porph. cousini.*"

O. augusti (Jousseaume). Pl. 44, fig 20.

Shell imperforate, fusiform-ovate, solid, lightly granule-striated, encircled by white and greenish bands. Spire conic, the apex obtuse; whorls 6, the first but little convex, the last four-sevenths the total length, more convex. Aperture oblong-oval, white within, with a pearly lustre; peristome violaceous, thickened, reflexed; columella white, slightly arcuate, the margins joined by a glossy callus. (*Jouss.*)

Alt. 69, diam. 34, length of aperture, 40 mill.

*Ecuador: Machai, valle del Pastaza*, 4900 ft. alt. (Wolf).

*Porphyrobaphe augusti* Jouss., Bull. Soc. Zoöl. de France, xii, p. 165, pl. 3, f. 10 (August 1, 1887).—Cousin, t. c., p. 203.—*Orthalicus* (*Pophyrobaphe*) *augusti* Reibisch, Sitzungsber. u. Abh. naturwiss. Gesell. Isis, in Dresden, 1896, p. 57 [*bis*] (1897).

This form is apparently a member of the group of *O. fraseri*, differing from that species chiefly in its simple columella. Good specimens will probably show a thimble-pitted nepionic shell. Jousseaume gives further details of the coloration as follows: The two earlier whorls are smooth and yellowish; the following ones are ornamented with fine longitudinal denticulated striæ, quite regular and crowded, and decussated on the later whorls by revolving striæ which are not

conspicuous, and more or less spaced. The color of the third whorl is formed of two zones of about the same width; the anterior one yellowish with brown spots behind, the posterior one white with quite large, spaced chesnut-brown spots; on the following two whorls there are waved lines of light chestnut on a yellowish ground, and occasional very irregular long spots of deep brown. The last whorl, which is a little ventricose, is of a dead-leaf color, ornamented with four revolving zones of very pale green, the anterior three wide and closer together than to the narrower posterior zone.

The locality in Ecuador of the original specimen was not known, but Dr. Wolf collected two specimens at the locality given above. One of them is very similar to the type in coloration, but the other, agreeing with the type in form and size, the coloration of the aperture, lips and columella, has four alternating narrow and broad bands composed of spots shaped like long, pointed scales. This is more like *O. fraseri*, and is considered by Herr Reibisch to be a more normal coloration than that of the type.

### Group of O. deburghiæ.

The shell is smoothish with fine and rather shallow spiral striation, a pure white aperture and strongly-folded columella. *O. deburghiæ* is not an uncommon shell, but *wrzesniowskii* is as difficult to get as its name is to pronounce, and *maranhonensis* is still known by the type specimen only.

*Key to species.*

*a*. Shell with numerous broad dark stripes separated by narrow zigzag yellow stripes, a wide subsutural zone paler; the periphery and a small basal tract encircled by interrupted blackish lines. *deburghiæ*, p. 196.

*a*$^1$. Shell flesh-tinted, with narrow brown streaks and dull lilac dots; aperture over half the total length. *wrzesniowskii*, p. 198.

*a*$^2$. Shell tawny, with livid clouds and irregular blackish streaks and spots; aperture less than half the total length. *maranhonensis*, p. 198.

O. deburghiæ (Reeve). Pl. 39, figs. 3, 5; pl. 42, figs. 9, 10, 11.

Shell ovate-conic, thick and solid. Pale yellow (white when denuded of the thin cuticle), with broad, zig-zag, blackish-olive (or when denuded, purplish-black) stripes which abruptly cease at the

upper fifth of the last whorl, or fade to a much fainter tint there, leaving *a broad, pale zone below the sutures;* the stripes becoming rich chestnut on the spire, the base with a small pale area below; *encircled by a narrow, frequently interrupted, peripheral, blackish-chestnut band, and a similar but less interrupted one at the base.* Surface rather smooth to the eye, but under a lens showing irregular growth-wrinkles, and *close, irregular spiral striæ.* Whorls 6½, moderately convex, the first three forming a netted-striolate or punctate nepionic shell, somewhat more attenuated than the subsequent outlines; apex obtuse; last whorl convex. *Aperture pure white throughout;* peristome thick, reflexed; columella with a strong, short fold above; *parietal callus heavy, pure white.*

Alt. 2¾, diam. 1¼ inch. (Reeve's type).

Alt. 61, diam. 33, longest axis of aperture 32½ mill. (fig. 31).

Alt. 75, diam. 34 mill. (Hidalgo, for *gloriosus*).

Alt. 78, diam. 34, aperture 38 mill. (Pfr. for *gloriosus*).

*Bulimus deburghiæ* Reeve, P. Z. S. 1859, p. 123.—Pfr., Monogr. vi, p. 15—*Porphyrobaphe deburghiæ* Miller, Malak. Blätt. (n. F.) i, p. 119.—Dohrn, Jahrb. d. D. Malak. Ges. ix, 1882, p. 112.—Cousin, Bull. Soc. Zoöl. France xii, p. 200.—*Bulimus gloriosus* Pfr., P. Z. S. 1861, p. 387, pl. 37. f. 4; Monogr. vi, p. 14.—Hidalgo, Mol. Viaje al Pacifico, p. 62, pl. 4, f. 2, 3.—*Porphyrobaphe gloriosus* Miller, Malak. Blätt. xxv, 1878, p. 185; and (n. F.), i, p. 200, pl. 5, f. 1 (var. *elongata*). *Conf.* Dohrn, l. c.—*Orthalicus* (*Porphyrobaphe*) *gloriosus* Martens, Conchol. Mittheil. p. 159.—Reibisch, Sitzungsber. u. Abhandl. Nat. Ges. Isis, 1896, p. 57 [*bis*] (1897).—*Bulimus duburghii* Reeve, Higgins, P. Z. S. 1872, p. 687.

Peru: *banks of Amazon river* (Reeve). Ecuador: *San José* (Isern and Espada); *Nanegal* (Wolf); *road to Canelos* (Stübel); *Riobamba* (Cisneros); *Machai, valle del Pastaza,* 4900 ft. above the sea (Wolf).

The broad pale zone below the suture, bold marking of the median portion of the body-whorl, and two narrow, interrupted girdles, with the fine spiral striation of the surface and pure white aperture, lips and parietal wall, easily separate this from the other species. Pfeiffer's *B. gloriosus* (fig. 9) has no varietal characters. The species is a variable one in size and contour, as well as in the prominence of the columellar fold. The number of whorls varies from 6½ in small shells, to 7 or 7½

in large ones. Miller distinguishes a *var. elongata* (fig. 5), which has a strong columellar tooth, and the last whorl attains only two-fifths the total altitude of the shell. Alt. 90, diam. 34, aperture inside 34 mill. long, 18 wide.

In one of the specimens taken by Herr Stübel, and recorded by Dr. von Martens, the flames disappear on the last whorl. Reibisch states that one of the 21 specimens collected by Dr. Wolf is 80 mill. long; several of the others being only 60 mill. One specimen is uniform brown, except for the characteristic black spiral lines.

O. WRZESNIOWSKII (Lubomirski). Pl. 42, figs. 7, 8.

Shell imperforate, ovate-elongate, solid, glossy, longitudinally striated, and very minutely decussated. Fleshy-fulvous, ornamented with longitudinal streaks of brown and dull lilac dots. Spire conic, obtuse; whorls a little convex, the last as long as the spire, tapering at base. Columella callous, plicate-twisted. Aperture ear-shaped, angular at the base, white within; peristome white, thick and expanded, the margins joined by a very glossy white callus, columellar margin folded and adnate. Alt. 78, diam. 37 mill.; aperture with the peristome 42 mill. long, 16 wide inside; peristome 4 mill. wide (*Lubomirski*).

*Tambillo, Peru* (Stolzmann).

*Bulimus* (*Porphyrobaphe*) *wrzesniowskii* LUBOMIRSKII, P. Z. S., 1879, p. 721, pl. 55, f. 7, 8.

In the form of the aperture this euphoniously named species agrees with *O. yatesi*, but the spiral discussating striæ and white lips, columella and parietal wall, ally it rather to *O. deburghiæ*. Described from a single specimen, now in the Varsovie museum. I am not aware that others have been found.

O. MARANHONENSIS (Albers). Pl. 41, figs. 3, 4.

Shell imperforate, ovate-oblong, solid, densely striated and decussated by very light, undulating spiral striæ. Tawny, livid-clouded, and irregularly painted with blackish streaks and spots. Spire long-conic, the apex obtuse; suture with a thread-like margin. Whorls 7, a little convex, the first minutely granulated, pale flesh-colored, the last shorter than the spire. Columella callous, white, strongly fold-twisted. Aperture little oblique, obauriform, whitish and glossy inside; peristome thickened, narrowly expanded, the margins

joined by a glossy whitish callus. Alt. 76, diam. 30; aperture, inside, 31 mill. long, 15½ wide (*Albers*).

*On the Marañon river in Colombia* [now Peru], (Warscewicz).

*Bulimus maranhonensis* ALB., Malak. Blätter, i, 1854, p. 216.—PFR., Novit. Conch. i, p. 42, pl. 11, f. 11, 12; Monogr. iv, p. 370.

Albers does not state the color of the lip, but it seems from the badly-colored figure to be white, shading into brown towards the outer edge. The Albers collection, now I believe in the Berlin museum, contains the only specimen yet put on record.

### GROUP OF O. LABEO.

Species without spiral striation, the peristome colored, varying from blackish to brown or flesh-colored, the columella folded; external coloring vivid in the species of Ecuador, rather plain in those of Peru.

#### *Key to Species.*

*a*. Peristome well reflexed (species of the Maranon drainage).

*b*. Peristome reddish; shell with broad chestnut zigzag streaks. *shuttleworthi*, p. 201

*b*¹. Peristome and parietal wall very dark or black brown; shell with narrow dark lines at periphery, base, and suture, and a few streaks.

*c*. Lip smooth, purplish brown. *vicarius*, p. 200

*c*¹. Lip punctured, very brown and dark. *labeo*, p. 199

*a*¹. Peristome reddish-brown or pink, blunt and thickened, more or less expanded, but hardly reflexed; color of arrow-shaped or trapezoidal spots in bands.

*b*. Aperture somewhat angular at base of the columella. *yatesi*, p. 202

*b*¹. Aperture evenly rounded beneath. *kelletti*, p. 204

O. LABEO (Broderip). Pl. 44, figs 21, 22.

"Shell stout, long-oval, of a brown-chestnut color, changing to red at the apex and on the upper whorls, which last are longitudinally striped with reddish-brown towards the suture. Whorls 6, ventricose; the last has a narrow black band across its middle, and another of the same color close to the suture, which is white; the last whorl but one has two narrow black bands, both near the sutures; the lower bands on the last and penultimate whorls are each thrice

interrupted. On the last whorl near the base, which is very dark, is a faint, broad, lighter colored band. The columella is remarkable for its obtuse white tooth, surrounded by the rich, dark coloring of the aperture. The right lip is of huge thickness, and much reflected; above it is of a light chestnut color; below of a rich brownish japan-like black, which, particularly where it is shading off into the chestnut, gives, when the light is thrown full on it, the same kind of iridescent appearance as is seen in the Lumachella, or fire-marble. The lower edge of this rich lip is punctured pretty thickly with dots, resembling those of *Cypræa testudinaria*, which seem filled with a whitish, opaque substance, and the formation of which has given an irregular and almost fungus-like appearance to the reflected border of the lip, on its upper side. The interior of the aperture is white. Length 3 inches, breadth, measured across the body-whorl, and including the lip, $1\frac{3}{4}$ inches." (*Brod.*)

*Toulea, about nine leagues east of Chachapoyas, Peru*, about 8000 ft. elevation (Lieut. Maw, R. N.).

*Bulinus labeo* Broderip, Zoöl. Journ, iv. p. 222, suppl. pl. 31 (1828).—*Bulimus labeo* Reeve, Conch. Icon. pl. 35, f. 207, copied from Broderip, (not pl. 71 and 72, f. 207 b, c.—Nyst, Bull. Soc. Roy. Bruxelles xii, p. 149, pl. 1, f. 2a, 2b.—Pfr., Monogr. ii. p. 56. —*Porphyrobaphe labeo* Shuttleworth, Notitiæ Malacologicæi, p. 71 (part), 89. *Cf.* Fulton, Ann. Mag. N. H. (6), xviii, p. 104.

The type specimen was deposited in the museum of the Zoölogical Society of London, but disappeared shortly afterward, and has not been recovered. Other specimens have since been found. It is evidently allied to *O. vicarius*, but the remarkably broad and curiously punctate peristome easily separates it from that and all other known species.

O. vicarius (Fulton). Pl. 44, figs. 18, 19; pl. 48, fig. 12.

Shell ovate-conic, thick and solid; pale pinkish-gray under a thin olive-yellow cuticle, mainly wanting on the spire, which is irregularly streaked with purplish, the last whorl with some inconspicuous dusky streaks, and a narrow dark band, more or less interrupted, at the periphery, another continuous one on the base just behind the columellar lip. Surface somewhat shining, with faint, low growth-wrinkles only. Whorls $7\frac{1}{3}$–8, the first one planorboid above, earliest $3\frac{1}{2}$ forming a closely pitted nepionic shell, the fourth whorl (at

least in some specimens), with a sub-sutural band of alternating chestnut and white spots, the rest of the whorls with a whitish hair-line bordering the suture below, edged below by a chestnut line; whorls convex, the last tapering below.

Aperture slightly oblique, white inside, angular at the base of the columella; peristome blackish purple-brown, thickened within, convex, broadly reflexed, and at the outer edge recurved and flesh-tinted; columella sub-vertical, with a fold or convexity near the base and a small white fold above; parietal and columellar callus thick, blackish brown.

Alt. 86, diam. 48, aperture with peristome 44 mill. long, 29 wide (type).

Alt. 79, diam. 37, greatest length of aperture 38½ mill. (fig. 12).

*Leimabamba, Peru*, on the road from Chachapoyas to Truxillo, 8000 feet elevation (Lobb, Baron).

*Bulimus labeo* Brod., Reeve, Conch. Icon., pl. 71, f. 207 b, pl. 72, f. 207 c.—Pfr., Monogr. iii, p. 306.—Morelet, Séries Conchyl. iii, p. 156.—? *Orthalicus* (*Porphyrobaphe*) *labeo* Brod., H. Adams, P. Z. S. 1866, p. 443. Not *Bulinus labeo* of Broderip. *Cf.* Shuttleworth, Notitiæ Malac., i, p. [89].—*Porphyrobaphe vicaria* Fulton, Ann. Mag. Nat. Hist. (6), xviii, p. 103 (July, 1896).

Formerly referred to *B. labeo* Brod. Shuttleworth in 1856 expressed the opinion that it was a distinct species, and Mr. Fulton has recently separated it from that form, basing the new specific term *vicaria* upon the specimen figured by Reeve (see pl. 44, fig. 18, 19). This specimen is more obese than the one before me (pl. 48, fig. 12). It "can be distinguished from *sublabeo* Ancey by its light olive color, the almost entire absence of markings, and the dark purple-brown of the columella and parietal wall."

O. shuttleworthi (Albers). Pl. 41, figs. 1, 2.

Shell imperforate, ovate-conic, solid, lightly striated. Whitish under a buff epidermis, irregularly ornamented with wide chestnut lightning-streaks. Spire conic, obtuse, suture a trifle marginated, whorls 6, a little convex, the last as long as the spire, a little attenuated at base. Columella callous, twisted. Aperture slightly oblique, obversely ear shaped, rose-whitish inside, glossy; the peristome reddish, thick, expanded and reflexed, the margins joined by a glossy

callus; columellar margin tuberculate and adnate. Alt. 71, diam. 29 mill.; aperture with peristome 37 long, 15 wide inside. (*Pfr.*).

*On the Marañon river in Colombia* [now Peru] (Warscewicz).

*Bulimus Shuttleworthi* Albers, Malak. Blätter i, 1854, p. 216.—Pfr. Monogr. Hel. Viv. iv, p. 371; Novit. Conch. i, p. 31, pl. 8, f. 14, 15.

Probably allied to *O. yatesi*. I have not seen the species.

O. yatesi (Pfeiffer). Pl. 43.

Shell imperforate, fusiform-oblong, solid, smooth, brown olivaceous with black bands interrupted by arrow-shaped buff markings. Spire long-conic, obtuse; suture lightly margined, whorls 8, a little convex, the last slightly exceeding two-fifths the total altitude, tapering at base. Columella calloused, strongly folded above. Aperture subvertical, elliptical oblong, subangulate at the base, bluish-white inside; peristome thickened, narrowly expanded, the margins joined by dull flesh-colored callus. Alt. 82, diam. 32, length of aperture inside 32, width 15 mill. (*Pfr.*).

*Peru: Moyobamba* (Yates, type locality); *Tarapoto* (Moricand, type locality of *latevittata*); *Tambo Yumbite*, near Moyobamba, 1479 meters above the sea (Stübel).

*Bulimus yatesi* Pfr., P. Z. S. 1855 p. 93, pl. 31, f. 5; Novit. Conch. i, p. 63, pl. 18, f. 1, 2; Monogr. iv, p. 371.—*Porphyrobaphe yatesi* Shuttl., Notitiæ, i, p. 90.—*Orthalicus* (*Porphyrobaphe*) *yatesi* Martens, Conchol. Mittheil. p. 159. Not *B. yatesi* Hupé.—*Porphyrobaphe latevittata* Shuttleworth, Notitiæ Malac., i, p. 71, pl. 5, f. 2, 3 (1856).—*Porphyrobaphe sublabeo* Dohrn, Ancey, Bull. Soc. Malac. France vii, p. 153.

The thick lip is fleshy or brownish; and the columella either white with a strong fold above (figs. 15, 17), or brown and straight below, white and weakly folded above (fig. 16). The nepionic shell is large, composed of $3\frac{1}{2}$ whorls, sculptured with fine more or less anastomosing longitudinal wrinkles, forming a striolate pattern over part and a pitted pattern over the rest of the surface. In *O. kelletti* only $2\frac{1}{2}$ whorls compose the pitted nepionic shell.

The original description of *yatesi* is given above, and fig. 17 is a copy of the original figure. It is an extremely variable species, distinguished from the closely allied *O. kelletti* by its bolder markings, and the subangular production of the aperture at the base of the

columella. This character is shown in an exaggerated form in fig. 12, but the artist has overlooked it in drawing figures 15 and 16. Another important feature separating *yatesi* from *kelletti* is the absence in the latter of the subsutural series of spots constantly present in *yatesi*, and the smaller number of pit-sculptured nepionic whorls. There are typically four bands of blackish-purple spots, the basal two more or less united, on a yellow ground with dusky streaks; but in specimens without cuticle the ground color is whitish, profusely streaked with purple. About $2\frac{1}{2}$ whorls at the summit are uncolored, the next whorl showing only a subsutural band of alternating dark and white spots. This series of spots descends gradually during post-nepionic growth, and becomes the upper band of arrow spots on the last whorl.

Var. *sublabeo* ("Dohrn" Ancey).

Differs from the allied species *P. yatesi* in the shorter spire, more slender, solid shell, more ovate, larger last whorl and consequently wider aperture, the peristome being thicker, much wider, deep chestnut colored; columella straight, thickened within, scarcely twisted, almost straight, forming a distinct angle with the base; whorls less numerous, 7, instead of $7\frac{1}{2}$ to 8 (Ancey).

*Amazonian region of Peru.*

Fig. 16 is probably referable to this ill-defined variety, though not typical of it.

Var. *latevittata* (Shuttleworth). Pl. 43, figs. 12, 13.

Shell elongate-ovate-conic, solid, nearly smooth, glossy; brown-purplish or chestnut-purplish, ornamented with two to four rather wide black-brown bands, interrupted by angulated straw-colored stripes, and above having narrow blackish-purplish streaks. Spire long conic, the apex as if cut off, the granulose nuclear shell narrowly banded with blackish-purple; suture bordered by an impressed line; whorls $7\frac{1}{2}$, moderately convex, the last a little shorter than the spire. Columella thick, plicate twisted, aperture scarcely oblique, truncated oblong-oval, bluish inside; peristome thickened, expanso-reflexed, pale livid purplish, glossy, the margins joined by a somewhat thickened whitish or livid callus, columellar margin sinuous. Alt. 85, diam. 35 mill.; aperture, including peristome, 38 long, 22 wide. (Shuttl.)

*Peru: Tarapoto* (Moricand).

Seems to differ chiefly in the obsolesence of part of the markings of the typical form. The specimens figured by Pfeiffer in the Novitates Conchologicae (see my figure 14) is evidently referable to this race, if such it proves to be.

O. KELLETTI (Reeve). Pl. 45, figs. 23, 24.

Shell ovate, rather ventricose; whorls 5, convex, roughly striated, somewhat plicately crenulated at the sutures, last whorl much the largest; columella thickened, peculiarly twisted. Aperture rather effused, lip thickened, reflected. Bluish-gray, encircled with four bands of a darker color, and longitudinally lightning-marked with narrow, waved and interrupted white streaks (*Rve.*)

Alt. 60, diam. 34, mill. (from figure.)

*Ecuador:* type locality unknown (Kellett); *Southern Ecuador* (Dohrn); *Cuenca, in the valley of Quito*, (Paz and Martinez, Orton.)

*Bulimus kellettii* REEVE, Conch. Icon., pl. 89, f. 661 (Feb., 1850). —PFR., Monogr. iii, p. 305; iv, 368; vi, 12.—FORBES, P. Z. S. 1850, p. 54.—*Porphyrobaphe kellettii* Reeve, DOHRN, Jahrb. d. D. Malak. Gesell., ix, 1882, p. 112.—COUSIN, Bull. Soc. Zoöl. France xii, 1887, p. 201.

*Bulimus fungairinoi* HIDALGO, Journ. de Conchyl. 1867, p. 72, pl. 4, f. 4 (typographical error for *fungairinoi*, see t. c. p. 468).—*B. fungairinoi* HIDALGO, Journ. de Conchyl. 1870, p. 44; Viaje al Pacifico i. p. 58, pl. 3, f. 8, 9.—CROSSE, Journ. de Conchyl. 1871, p. 316.—PFR., Monogr. vi. p. 12; viii. p. 16.—*Cf.* Dohrn, l. c.—*Porphyrobaphe fungairinoi* MILLER, Mal. Bl. xxv. p. 185.—COUSIN, Bull. Soc. Zoöl. France, xii. p. 200.—*Bulimus jatesi* (Shuttleworth), HUPE, in Castlenau, Exped. dans l'Amer. du Sud, Moll.. p. 31, pl. 8, f. 1, 1a (where it is erroneously lettered *B. bensoni* Reeve).

If there be any division between typical *kelletti* and the variety or form *fungairinoi*, the former will be restricted to shells with four subequal bands and wide contour, as in the original figures, pl. 45, figs. 23, 24; and the varietal name proposed by Hidalgo will include forms with the upper band narrow, the median wider, and the two basal bands wide and to a greater or less extent coalescent, the whole shell being of narrow contour (pl. 45, figs. 25–28).

In the variety *fungairinoi*, the folds below the suture are sometimes well-developed, as in fig. 27, sometimes entirely absent, as in

Hidalgo's types, and some shells before me. The ground-tint is sometimes a rich yellow with some dusky streaks, sometimes a beautiful light purple, the bands being deep purple-black with white veins. The peristome in all known forms of the species is reddish-brown or brownish-red, the parietal callus more of a chestnut or blackish color.

Dohrn, who united the two forms, writes as follows: Narrow and broad, large and small specimens of this species occur; the columella is sometimes strongly folded, sometimes passes in a simple curve into the outer lip; and now green, now yellow predominates in the coloration, only rarely a tone of green passing into lead-gray occurring. The number of bands is 4, not 3 as Hidalgo holds, but not infrequently the two lower bands coalesce. The upper whorls may be either white or roseate, In many shells the four growth-periods are very characteristically separated by differences in the markings, so that either ground-tint or the decoration of zigzag lines is changed. At the base just behind the columellar callus, there is a long small elongate tract of the shell which is denuded of cuticle, plicate and purplish-red (or ash-gray). As this is present upon all my specimens, I consider it a specific character. Measurements of several specimens are as follows:

Alt. 71, diam. 34, length of aperture 44, breadth 26 mill.

Alt. 71, diam. 28, length of aperture 34, breadth 22 mill.

Alt. 61, diam. 29, length of aperture 37, breadth 24 mill.

Alt. 58, diam. 25, length of aperture 30, breadth 19 mill.

Hupé gives Peru as the locality of the specimens collected by Count Castelnau. They are the form of *fungairinoi*, but the markings are somewhat reduced, showing more of the ground color than usual.

### Group of O. atramentarius.

Chiefly a group of central Colombia, distinguished by the blunt lip, but little and gradually expanding, and bordered broadly with violet or purple inside. The species are among the most superb of South American land snails. They vary considerably in color, and are closely allied.

#### *Key to species.*

*a.* Aperture pure white within; shell usually with a peripheral dark girdle.

*b*. Spirally striated, though the striæ are fine and shallow; form rather conically ovate. *adamsoni*. p. 207.

*b*¹. No spiral striation; and of more fusiform contour.

*c*. Spire purple, last whorl tawny or olivaceous-brownish; lip black, shading into violet within; columella vertical, folded; alt. 59–67 mill. *approximatus*, p. 208.

*c*¹. Glossy, light fawn-colored usually with some dark markings, spire thick below, attenuated above, lip brown, purple within. *powisianus*, p. 206.

*a*¹. Aperture tinted within; surface rather rough, heavily blotched or mottled, or with the last whorl dark throughout; peristome dark brown, becoming reddish-purple within. *atramentarius*, p. 209.

O. POWISIANUS (Petit). Pl. 37, figs. 28–34.

Shell oblong-conic, solid and strong, *light fawn colored* with numerous inconspicuous slightly darker streaks, and usually some purplish blotches and streaks; *begirt a little below the periphery by a narrow brown-black band* somewhat uneven in width, and narrowly light-edged in places; this band ascending the spire, showing a little at the suture; some of the earlier whorls with a continuous or interrupted median brown line, first whorl brown-topped; on the last whorl or two a dark line (often interrupted) borders the whitish suture below. Surface polished, glossy, with faint growth-lines, stronger at the sutures. Spire convexly conic below, concavely conic above, apex obtuse, flattened. Whorls 7, the earlier 3 regularly thimble-pitted, those following almost flat, penultimate and last whorls slightly convex, the latter obliquely produced and spreading outwardly and downward, near the aperture, with a narrow blackish streak behind the lip: the base flatly tapering to a rounded ridge behind the columella.

Aperture oblique, *rhombic*, somewhat effuse below, *pure white within, with a broad purple internal lip-border;* peristome obtuse and thick, black-brown; columella subvertical, white, and a trifle tortuous above, purple below, parieto-columellar callus brown-black.

Alt. 74, diam. 35, longest axis of aperture 38 mill.

Alt. 68, diam. 33½, longest axis of aperture 35½ mill.

*Colombia: Marmato, and the forest on the east side of the Cauca, on the road to Salamina*, on damp banks under trees and on shrubs (Bland); *Forests on the Cauca River* (Lehmann and others).

*Bulimus powisianus* PETIT de la SAUSSAIE, Revue Zoölogique 1843, p. 239; Guerin's Magasin de Zoölogie (2), 1843, Moll., pl. 65.—DESH. in Fér. Hist., pl. 128, f. 1, 2.—REEVE, Conch. Icon. pl. 27, f. 167 a, b, c.—PFR., Monogr. ii, p, 140; iii, 378.—BLAND in C. B. Adams' Contrib. to Conch. No. 11, p. 229.—DUNKER, Jahrb. d. D. Malak. Ges. ix, 1882, p. 379, pl. 11, f. 3, 4.—*Orthalicus* (*Corona*) *powisianus* SHUTTLEWORTH, Notitiæ Malac. i. p. 68.—*Porphyrobaphe powisiana* Petit, MOUSSON, Malak. Blätter, xxi, p. 13.—KOBELT, Jahrb. d. D. Mal. Ges. ii. 1875, p. 223, pl. 7, f. 2.

Very distinct in its glossy surface and light color, the flattened whorls and somewhat mammillar apical portion. Petit's type was a rather small example, length 68 mill., but others as short as 63 mill. have occurred. The locality was doubtfully given as Bogota by Pfeiffer, the type having been collected by Goudot; but later information locates it in the Cauca valley.

There is wide variation in the amount and prominence of the dark streaks or blotches, and they are sometimes obsolete. Reeve's figures (copied in my figs. 28 and 32) show the whorls more convex than the type or any specimen I have seen, and the streaks of fig. 28 are far more prominent than in the typical form.

Figures 31 and 34 are drawn from Marmato specimens received from Bland. The young shell is acutely angular at the periphery.

A specimen collected by Bland laid three dark olive-brown oval eggs, about 10 mill. long, 8 wide; the surface of the egg-shell is strongly granulose.

O. ADAMSONI (Gray). Pl. 39, figs. 1, 2; pl. 40, figs. 7, 8.

Shell ovate-fusiform, thick and solid. "Violaceous-ashy, somewhat olivaceous toward the base, sparsely clouded here and there with brown, encircled by a conspicuous bluish-white band which is somewhat distantly articulated with olive-black, and with a subobsolete brownish band above," (pl. 39, figs. 1, 2); or dull reddish on the spire, obscurely streaked with darker, a median spot-band appearing on the penultimate whorl, the latter part of which is pale ashen above, olivaceous below the band, and copiously streaked with black; the last whorl with a wide ashen zone above, the lower three-fourths olivaceous, the whole profusely streaked and spotted with black; there is a narrow peripheral black girdle bordered above by a wider white one, which is frequently interrupted by black blotches;

on the latter half somewhat stained with reddish-chestnut, and then becoming almost uniform black (pl. 40, figs. 7, 8). Surface somewhat shining, with slight growth-wrinkles and close, rather coarse and shallow spiral striæ, subobsolete on the last whorl. Whorls 6 to 7, the apex decollate and plugged (at least in the specimen before me); nepionic shell probably composed of at least 3 whorls, which are densely pitted; last whorl oblong, tapering below.

Aperture oblique, rhombic-oval, white inside; peristome slowly but decidedly expanding, thick, obtuse, purplish black at the edge, with a broad, blackish-violet border within, shading into violet and then white; columella violet, somewhat cylindrical, subvertical and indistinctly bisinuate; parietal callus and the reflexed columellar callus black throughout.

Alt. 87, diam. 42, longest axis of aperture 46 mill.

Alt. 89, diam. 47 mill. (from Reeve's figure of the type.)

*Colombia:* "*Parremo*," *near the volcano Tolima* (Adamson coll.); *valley of Guaduas* (Gen. J. Acosta); "*Bogota*" (pl. 40, f. 7, 8).

*Bulinus adamsonii* Gray, P. Z. S., 1833, p. 123.—*Bulimus adamsonii* Reeve (de novo), Conch. Icon. pl. 26, f. 165 (1848).—Pfr., Conchyl. Cab., p. 242, pl. 65. f. 1, 2; Monogr. iii, p. 307; iv, p. 370; vi, p. 14.—Hupe in Castelnau's Exped. dans l'Amér. du Sud, Moll., p. 32, pl. 8, f. 2.—Bland in C. B. Adams' Contrib. to Conch. no. 12, p. 231.

The type of *B. adamsonii* (pl. 39, figs. 1, 2), was only rather faintly mottled. The specimens figured by Hupé and Pfeiffer, and that shown on my plate 40, figs. 7, 8, are much more heavily veined and mottled, and constitute a color-variety *maculatus*. It is a larger species than *O. atramentarius*, white within, and differently marked externally.

This is not *Orthalicus adamsonii* of Beck, which is *O. bensoni* Reeve. Beck's reference to a figure in Gray's Spicilegia Zoölogica is apparently a mistaken one. There is no such figure in that work.

O. approximatus (Fulton). Pl. 40, figs. 1, 2, 3.

Shell oblong-conic, thick and solid; whorls of the spire largely denuded of cuticle, whitish-purple with a series of oblong purple spots above the sutures separated by small white spots, and sometimes a medium interrupted girdle; the last whorl covered with a thin cuticle, somewhat yellowish or olivaceous-tawny, becoming reddish

in tint on the latter half, and girdled by a broad blackish band at the periphery, with traces of one or two fainter dusky bands above; having some oblique variceal dark streaks. Surface glossy, with close, irregular wrinkles of growth, roughened at the varices. Whorls 6 (in a decollate and plugged specimen, figs. 2, 3; but $6\frac{1}{2}$ according to Fulton), the apical $2\frac{1}{2}$ thimble-pitted, those of the spire hardly convex, the last oblong, convex; apex obtuse.

Aperture oblique, ovate, pure white within, but with a very wide black internal border shading through violet into the white; peristome obtuse, thick, a trifle expanded, black; columella vertical, bisinuate, the upper fold or nodule much stronger, purple tinted, the lower one slighter; parietal callus black.

Alt. 59, diam. 29, longest axis of aperture 29 mill.

Alt. 67, diam. 31 mill. (type).

*Bogota, Colombia.*

*Porphyrobaphe approximata* Fulton, Ann. and Mag. N. H. (6), xviii, p. 103 (July, 1896); xx, pl. 6, f. 6, (1897).

Allied to *O. atramentarius*, *adamsoni* and *powisianus*. From the last of these it differs in coloring, the more oblique aperture, and the straight lateral outlines of the spire. *O. adamsoni* is much larger, with more ample body-whorl, and has spiral striæ; it agrees in the coloring of the aperture. *O. atramentarius* is much more closely related to *approximatus*, differing from it chiefly in the different color-pattern of the exterior, the browner black of the lip and parietal wall, and the red-purple rather than violet or blue-purple internal shading of the lip-border, and the tinted instead of pure white color of the interior. The form of the columella is closely approached by some specimens of *atramentarius*.

Fig. 1 represents the type; 2 and 3 are from a specimen received from the author.

O. atramentarius (Pfeiffer). Pl. 38; pl. 39, fig. 7.

Shell ovate-conic or oblong-conic, thick and solid; two or three early whorls flesh-tinted, the succeeding whorls of the spire fleshy or white, with irregular, broad ragged stripes and narrower oblique streaks of purple-brown, the last whorl (1) whitish-lilac or pale brownish with similar stripes, streaks and spots, or an indefinitely mottled pattern, or (2) wholly or on the last half of a uniform blackish-purple color; sometimes showing an obscure band at the per-

iphery (as in figs. 35, 37), and above (fig. 38); the general blackness sometimes interrupted by some dirty white, rough varices (as in fig. 37). Surface sculptured with irregular growth-wrinkles, often rougher and finely plicatulate on the last whorl, the latter half of which is frequently coarsely plicate. Whorls $6\frac{1}{2}$ to 7, the first obtuse, often amputated and plugged, the rest moderately convex.

Aperture oblique, ovate, red-purple within, becoming paler in the throat and darker towards the lip; peristome blunt, not expanded, pale-edged, with a dark-brown border inside; columella purple, bisinuate, its reflexed callus and the strong parietal callus almost black.

Alt. 69, diam. 34, longest axis of aperture 36 mill.

Alt. 62, diam. 29, longest axis of aperture 32 mill.

Alt. 61, diam. 32, longest axis of aperture 32 mill.

*Colombia: Chopa, in the province of Pamplona* (Linden); *Cucuta* (Bland); *Canelos, Ecuador* (Stübel).

*Achatina regina* B, Pfr., Monogr. Hel. Viv. ii, p. 244.—*A. regina* Desh. in Fér., Hist., p. 145, pl. 122, f. 8, 9.—*Bulimus regina* (part) Reeve, Conch. Icon. pl. 27, f. 168 b.—*Achatina atramentaria* Pfr., P. Z. S. 1855, 116.—*Orthalicus atramentarius* Pfr., Monogr. iv, p. 591; vi, p. 202.—*O.* (*Corona*) *atramentarius* Pfr., Malak. Blätt. 1855, p. 167.—*Bulimus boussingaultii* Hupe in Castelnau's Exped. dans l'Amér. du Sud Moll., p. 37, pl. 9, f. 2 (1857).—*Orthalicus* (*Corona*) *iodes* Shuttleworth, Notitiæ Malacologicæ, i, p. 68, pl. 4, f. 8 (1856).—Martens, Conchol. Mittheil. p. 159.

Smaller than *O. adamsoni*, differently colored, the aperture pinkish-purple within, while in *adamsoni* it is white, shading into violet or bluish-purple toward the lip-margin. The last whorl varies from mottled to a uniform blackish-purple in specimens from a single locality; my figures 36, 37 and 7 being drawn from shells collected at Cucuta. Pfeiffer gives the length of his type as 81 mill., which is larger than any of the specimens in our collection. Occasional shells (figs. 36, 37) have some patches of a scarlet-brown color at the edge of the blackish tract. Something of the same sort is seen in some specimens of *O. adamsoni*.

Both of the synonyms, *iodes* and *boussingaultii*, were based upon the true *atramentarius*, and do not stand for varietal forms.

## Sub-family AMPHIBULIMINÆ.

Includes *Amphibulima*, *Rhodonyx*, *Pellicula*, *Gæotis*, *Peltella*, *Simpulopsis* and *Eudioptus*.

Arboreal or sub-arboreal *Bulimulidæ* with the shell degenerate as a protective organ, *Succinea*-shaped, *Haliotis*-shaped, or in the less reduced forms, globose or ovate; always thin, and mainly cuticular; unicolored and more or less translucent (except in *Amphibulima*). Jaw, radula and genitalia of Bulimulid type.

An American group of genera, which agree in having the shell in various stages of degeneration. In *Bulimulopsis* only the incipient stage of this process of reduction has been reached; *Simpulopsis* is a later stage, and *Peltella* and *Gæotis* seem to be terminal members of the series, being slug-like in form. *Amphibulima* with its satellite groups *Rhodonyx* and *Pellicula*, stand a little apart from the other series. The exact inter-relationships of the various genera cannot be understood until a comparative study of the soft parts, more fundamental than has yet been made, is undertaken. *Peltella* is the only genus which has been adequately investigated. It may turn out that *Drymæus*, *Liostracus* and *Bulimulopsis* converge to a common origin; *Simpulopsis* being a further development of the last of these groups, and *Peltella* another member of the series. Just where *Platysuccinea* belongs is doubtful, but *Gæotis* may be related to it as *Peltella* to *Simpulopsis*. *Amphibulima* may trace its ancestry to the *Liostracus-Bulimulopsis* root, or it may possibly be descended from *Bulimulus*. I look to the general arrangement or "topography" of the viscera, for the solution of these problems, rather than to any information to be gained by study of the details of genitalia or teeth.

Our knowledge of the anatomy of the *Amphibuliminæ* is due chiefly to Dr. Paul Fischer, Dr. H. von Ihering, and Mr. W. G. Binney, all of whom have contributed valuable data.

*Key to genera, by shell-characters.*

I. Shell subglobose, ovate or oblong, varying in form from Naticoid to Bulimuloid. SIMPULOPSIS, p. 212.

II. Shell depressed, the whorls open beneath, columella reduced to a spiral rib not concealing the interior of the whorls. PELTELLA, p. 231; GÆOTIS, p. 227.

III. Shell Succinea-shaped. AMPHIBULIMA, p. 232.

## Genus SIMPULOPSIS Beck, 1837.

*Simpulopsis* Beck, Index Moll., p. 100.—Martens in Albers' Die Heliceen, p. 308 (type *S. sulculosa* Fér.). Pfr., Nomencl. Hel. Viv., 1878, p. 228.—*Simulopsis* Gray, P. Z. S., 1847, p. 171 (type "*Helix sulcosa*").

Shell imperforate, varying from globose to ovate, very thin, mainly cuticular, usually with few whorls; the last very large; apical $1\frac{1}{3}$ to $1\frac{1}{2}$ whorls with excessively fine spiral striation, except in subgenus *Platysuccinea*; aperture large, rounded lunate or ovate, oblique; peristome and columella very thin, simple and arcuate. Type *S. sulculosa* Fer.

The jaw is arched and composed of numerous plaits, as in *Drymæus;* radula about as in *Bulimulus*, but the cusps of the teeth are more strongly developed.

The species live on and among plants in moist woods. The group was at first associated with *Succinea;* Pfeiffer then placed the species in *Vitrina*. It was recognized as a genus by Mörch in 1852, and by Shuttleworth in 1854; these authors being followed by Pfeiffer. Dr. Paul Fischer, in 1873, was the first to recognize the Bulimulid affinities of the group.

The typical group of species occurs in Brazil, from the State of Bahia to Sao Paulo; but one species has been found in Trinidad and another in Nicaragua. An aberrant group of forms with smooth apical whorls is found in the West Indies and Eastern Mexico. Several old-world forms have been referred to *Simpulopsis* (see p. 226), but their status is uncertain.

The species fall into three sections or subgenera:

I. Apical whorls spirally striate.

1. *Simpulopsis* s. str. Short globose shells, excessively thin, mainly cuticular, somewhat flexible, with 3 to $4\frac{1}{2}$ whorls; corrugated or merely wrinkled, varying from greenish-yellow to olive-brown.
2. *Bulimulopsis* Pilsbry, 1899. Oblong-ovate or globose-conic, higher than wide, *smooth*, glossy and brittle, *light tinted;* whorls 4 to $5\frac{1}{2}$. Brazil. (See p. 220.)

II. Apical whorls smooth.

3. *Platysuccinea* Ancey, 1881. Globose, thin, rather brittle, with $2\frac{1}{2}$ to $3\frac{1}{2}$ whorls; striated or smooth, light-

colored. Type *S. portoricensis*. Greater Antilles and Mexico. (See p. 223.)

Section SIMPULOPSIS.

*Species of South America and Trinidad.*

*Key to species.*

*a*. Shell smooth or nearly so, about as wide as high; whorls $3\frac{1}{2}$. *atrovirens*, p. 213.

*a*$^1$. Shell longitudinally corrugated or folded, not decussate.

*b*. Higher than wide, the spire prominent, whorls about $4\frac{1}{2}$; folds coarse, irregular and low. *sulculosa*, p. 214.

*b*$^1$. Diameter about equal to or exceeding the width; whorls 3 to 4.

*c*. Folds close, subregular and strong; whorls 3 to $3\frac{1}{2}$.

*d*. Diam and longest axis of aperture exceeding alt.; spire very short, low; outer lip inserted above periphery of penult. whorl. *braziliensis*, p. 215.

*d*$^1$. Diam. exceeding alt.; spire short; outer lip inserted at periphery of penult. whorl. *obtusa*, p. 216.

*d*$^2$. Diam. and alt. about equal; spire conic; length of aperture less than that of shell.

*e*. Olive or olive-brown; alt. about 14 mill. *rufovirens*, p. 216.

*e*$^1$. Light green; alt. 9 to 10 mill. *corrugata*, p. 217.

*c*$^1$. Folds strong, irregular; whorls 4; alt. $17\frac{1}{2}$, diam. 24 mill. *miersi*, p. 218.

*a*$^2$. Shell corrugated and decussate.

*b*. Irregularly plicate, with extremely fine spiral striæ; whorls $4\frac{1}{2}$; alt. and diam. about equal; alt. 20, diam. 19 mill. *tryoni*, p. 218.

*b*$^1$. Closely plicate, with spiral sulci; whorls $4\frac{1}{2}$; alt. 11; diam. $12\frac{1}{2}$ mill. *decussata*, p. 218.

S. ATROVIRENS (Moricand). Pl. 64, figs. 79, 80.

Shell semi-oval, ventricose, excessively thin, being mainly cuticular; olive-green or reddish-brown, becoming paler on the spire; *sur-*

*face dull, lusterless* or with a somewhat silken sheen, *nearly smooth, but with some low and irregular wrinkles* or folds, but more regularly and more closely plicate on the penultimate whorl. Spire small and short; whorls $3\frac{1}{2}$, the last extremely large and inflated, well-rounded throughout. Aperture very oblique, large, rounded, ovate; peristome thin and sharp, the outer lip usually with a cuticular and more or less distorted edge; columella long, concave, thin.

Alt. 15, diam. 15, longest axis of aperture $14\frac{1}{2}$; width $10\frac{1}{2}$ mill.

*Portas, Prov. Bahia, Brazil*, on palms (Blanchet); *Bahia* (Acad. coll.)

*Helix* (*Cochlohydra*) *atrovirens* Moric., Mem. Soc. Phys. et d'Hist. Nat. de Genève, vii, p. 416, pl. 2, p. 1 (1835 or 1836).—*Vitrina atrovirens* Jay, Catal., 1839, p. 43.—Pfr. Monogr. ii, p. 511.—*Simpulopsis atrovirens* Mor., Beck, Index Moll., p. 100.—Pfr., Conchyl. Cab., p. 30, pl. 3, f. 5, 6; Monogr. iii, p. 7; v, p. 22.

In general appearance this species resembles the corrugated forms, but the folds are almost obsolete. A number of specimens before me, including two from Moricand, show very little variation in sculpture, and the species seems well founded.

S. sulculosa (Férussac). Pl. 64, figs. 81, 82, 83.

Shell globose-conic, *higher than wide*, excessively thin, pale greenish-yellow, transparent, *surface glossy, showing under a lens numerous revolving dull and lustreless bands* about as broad as the glossy intervals; *irregularly sulcate* or wrinkled, *the wrinkles rather widely and unevenly spaced*, subobsolete on the spire. *Spire conic* and elevated. Whorls about $4\frac{1}{3}$, the last globose. Aperture ovate, moderately oblique; outer lip thin and acute; columellar lip thin, concave.

Alt. 11, diam. $9\frac{1}{2}$, longest axis of aperture 8.3, width 6 mill.

*Prov. Sao Paulo, Brazil, at Itapetininga* (v. Ihering) *and Taguara* (v. Ihering, teste Clessin); *Botafogo*, near Rio Janeiro, among plants in moist places (Paz and Martinez).

*Helix* (*Cochlohydra*) *sulculosa* Fér., Prodr., p. 27; Hist., pl. 11 A, f. 6.—*Succinea sulculosa* Gray, Ann. of Philos., ix, 1825, p. 415.—*Vitrina sulculosa* Pfr., Symbolæ, iii, p. 45: Monogr., ii, p. 512.—*Simpulopsis sulculosa* Beck, Index, p. 100.—Clessin, Mal. Bl. (n. F.), x, p. 168.—Pfr., Conchyl. Cab., p. 31, pl. 3, f. 7, 8.—Heynemann, Malak. Blatt., xv, 1868, p. 110, pl. 5, f. 10 (dentition).

—Hidalgo, Viaje al Pacifico, p. 5.—*Succinea membranacea* Mich., teste Villa, Dispositio Syst., p. 9.—Not *S. sulculosa* H. & A. Adams, Gen. Rec. Moll., pl. 73, f. 1.

This rather small species of southern Brazil is easily recognized by the coarse and irregular shallow sulcation and the prominent and conic spire. Well-preserved shells show many dull bands on a brilliant ground, scarcely visible without a lens, and varying in degree of development in different specimens. In the collections I have seen, the name *sulculosa* seems to have been often applied to other species.

Dr. Hidalgo reports specimens with $4\frac{1}{2}$ whorls, measuring, alt. 15, diam. 13 mm., from Botafogo, near Rio Janeiro.

S. brasiliensis (Moricand). Pl. 64, figs. 84, 85.

Shell semi-oval, ventricose, very thin, pale greenish-yellow, subtransparent. Surface glossy, regularly and deeply corrugated, the folds rather close and nearly regular, smooth or nearly so; no spiral sculpture. *Spire very short and low.* Whorls $3\frac{1}{2}$, the earlier $1\frac{1}{2}$ or 2 smooth, the last whorl very large and globose. Aperture quite oblique, large, rounded-ovate; peristome thin and sharp, the *outer lip inserted above the periphery of the penult. whorl;* columella thin, somewhat concave, *meeting the basal lip in a salient angle*, in the middle of the apparently columellar margin.

Alt. 12, diam. 13, longest axis of aperture 12.3, width 9 mill.

Alt. 11.5, diam. 12, longest axis of aperture 12, width 8 mill.

Alt. 12.5, diam. 15, longest axis of aperture 13.5, width 10 mill.

*S. Gonzalves, Brazil*, in humid forest (Blanchet).

*Helix* (*Cochlohydra*) *brasiliensis* Sowerby, Moricand, Mem. Soc. Phys. et Hist. Nat. Genève, vii, 1835–6, p. 416 (no sufficient description); Mem., etc., xi, p. 148, 149, 160, pl. 5, f. 5 (as *Succinea brasiliensis*), 1845–6.—*Vitrina brasiliensis* Mor., Pfr., Symbolæ, ii, p. 62 (1842), no description.—*Vitrina obtusa* Sow., Pfr., Monogr., ii, p. 511 (1848).—*Simpulopsis obtusa* Pfr., Monogr., iii, p. 7; Conchyl. Cab., p. 29, pl. 3, f. 1, 2.

Distinguished chiefly by its extremely short, low spire and high insertion of the outer lip. The angulated columellar margin, caused by the meeting of the arc of the basal margin with that of the columella, is not constant, the angle being often obsolete.

This species has been called *obtusa* Sow. by Pfeiffer, but I find it

impossible to reconcile Sowerby's figures with these shells. Moreover, Sowerby described his species too briefly, and simultaneously proposed two specific names for it.

Moricand had been incorrectly informed by Férussac that Sowerby had named this species "*brasiliensis*," and therefore attributed the name to that author.

S. OBTUSA (Sowerby). Pl. 64, figs. 86, 87.

Shell ovate, corneous, longitudinally striated; spire very short; whorls 3, a little convex; aperture ovate, oblique. Length to the breadth as 2 to 3 (*Sowerby*). *Brazil.*

*Succinea ovata* SOWERBY, Genera of Shells, pt. ix, second page of text, *Succinea.*

*Succinea obtusa* SOWERBY, Genera of Shells, legend at foot of plate of *Succinea* (1820 or 1822; see Ann. Mag. N. H. (6), xiii, p. 371). —REEVE, Conch. Syst., ii, p. 89, pl. 180, f. 2 (reprinted from Sowerby's plate).—*Helix obtusa* FER., Hist., pl. 9 B, f. 5 (copy of Sowerby's figure).—*Simpulopsis obtusa* BECK, Index, p. 100.

According to Sowerby's figures, which there is no reason to think incorrect, this species has a decidedly more projecting spire than *S. brasiliensis*, and the outer lip is inserted much lower on the penultimate whorl.

Sowerby called this species "*S. ovata*" in the text, "*S. obtusa*" on the plate. Pfeiffer has chosen to retain the latter, ignoring the former name. As I can add nothing to our knowledge of the species, it is not worth while to question the propriety of Pfeiffer's favoritism in dealing with the twins.

S. RUFOVIRENS (Moricand). Pl. 64, figs. 88, 89, 90, 91.

Shell semi-globose, very thin, olive-green or brown-tinted olive; somewhat shining but not glossy. Surface closely and strongly corrugated, the corrugation rather regular, though sometimes folds split or are intercalated. Spire conic. Whorls $3\frac{1}{2}$, moderately convex, the last globose; suture slowly descending in front. Aperture rounded-ovate, very oblique, the outer lip thin, its upper end inserted at or near the periphery of the penultimate whorl; columellar lip very thin and regularly arcuate.

Alt. 14, diam. 14, longest axis of aperture 12.4, width 9.5 mill.

*Province of Bahia, Brazil* (Blanchet, Anthony).

*Helix* (*Succinea*) *rufovirens* Moric., Mem. Soc. Phys. et Hist. Nat. Genève, xi, p. 147, pl. 5, f. 4 (1845–6).—*Vitrina rufovirens* Pfr., Monogr. ii, p. 511.—*Simpulopsis rufovirens* Pfr., Conchyl. Cab., p. 30, pl. 3, f. 3, 4; Monogr. v, p. 22.—*Simpulopsis rufescens* Mor., Adams, Gen. Rec. Moll. ii, p. 128.

This species from the number of specimens before me, must be found in some abundance. It is wider than *sulculosa*, with fewer whorls, lower spire and finer corrugation. The spire is decidedly more raised than in *brasiliensis*, and the outer lip is inserted lower. The deep, rather fine and even corrugation is its most prominent feature.

S. corrugata Guppy. Pl. 64, figs. 93, 94, 95.

Shell globose, very thin and fragile, being mainly cuticular; light green, translucent in places. Surface glossy, deeply corrugated, the ribs subregular, but in places a little irregular. Spire short, conic. Whorls $3\frac{1}{2}$, the earlier $1\frac{1}{2}$ smooth; last whorl inflated, rounded. Aperture large, subcircular, but somewhat excised by the penult. whorl, moderately oblique; peristome thin, regular arcuate; columella arcuate, thin; no perceptible parietal callus.

Alt. 9.3, diam. 9, longest axis of aperture 7.7, width 5.7 mill.

*Trinidad*, *near Savana Grande*, in humid forests; rare (Guppy).

*S. corrugatus* Guppy, Ann. and Mag. N. H. (3), xvii, 1866, p. 53.—*S. corrugata* Guppy, Pfr., Monogr. vii, p. 28.—Guppy, Journ. de Conchyl. 1878, p. 323, pl. 10, f. 3; Journ. of Conch. vii, 1893, p. 221.—Binney, Bull. Mus. Comp. Zoöl., v, p. 338, pl. 1, f. G (dentition).—Crosse, Journ. de Conchyl., 1890, p. 46.—*S. rufovirens* Mor., E. A. Smith, Journ. of Conch., viii, p. 244.

Similar to *S. rufovirens*, but constantly smaller, of a lighter green color when in good condition, and with the aperture perceptibly less oblique.

Mr. E. A. Smith unites *corrugata* to *rufovirens* as a synonym, but the differences indicated above are constant in the series before me, and with the wide geographic separation of the two forms, seem to make it desirable to retain the species or subspecies. "Species," however, among the slightly differentiated forms of this genus, are more conventional than usual; and in this instance we totally lack material from the vast intermediate region, the Amazon valley.

S. MIERSI Pfeiffer. *Unfigured.*

Shell conic-subglobose, very thin, somewhat irregularly, strongly plicate, pellucid, rather shining; olivaceous-corneous. Spire short, conic, acute; whorls 4, moderately convex, separated by a somewhat channelled suture, the last whorl inflated, regularly descending. Aperture oblique, ample, lunate-oval; peristome thin, black-edged, the right margin rather widely expanded, columellar margin hair-like, somewhat twisted above. Alt. 17½, greater diam. 24, lesser 17½ mill. (*Pfr.*)

*Espirito Santo, Brazil* (Miers, in Cuming coll.).

*S. miersi* PFR., Malak. Blatter, iii, 1856, p. 260; Monogr. iv, p. 800; v, p. 21.

Known to me by the above description only.

S. TRYONI Pilsbry, n. sp. Pl. 64, fig. 92.

Shell globosely semi-oval with conic, projecting spire, thin, light olivaceous; surface lusterless, rather irregularly corrugated, and under a strong lens seen to be *spirally sculptured with extremely fine, dense, cuticular striæ*, passing over the folds and intervals. Whorls 4½, the last globose. Aperture very oblique, rounded-ovate, the peristome thin and sharp; columella regularly arcuate.

Alt. 20, diam. 19, longest axis of aperture 16, width 12 mill.

*Brazil* (J. G. Anthony).

The folds are much less regular than in *S. rufovirens*, and that species shows no spiral striation.

S. DECUSSATA Pfeiffer. *Unfigured.*

Shell conic-subglobose, very thin, *closely plicate and rather regularly decussated by spiral sulci;* pellucid, shining, olivaceous-corneous. Spire moderate, conic, acute; suture deep. Whorls 4½, moderately convex, the last one ventricose. Aperture oblique, rounded-oval, slightly angular above; peristome simple, unexpanded; columellar margin lightly arcuate, very slightly twisted above. Alt. 11, greater diam. 12½, lesser 10 mill. (*Pfr.*)

*Petropolis, near Rio Janeiro, Brazil* (Miers, in Cuming coll.).

*Simpulopsis decussata* PFR., Malak. Bl. iii, 1856, p. 260; Monogr. iv, p. 800; v, p. 22.

I have not seen this species, which is apparently well distinguished by its spiral grooves decussating the longitudinal folds.

*Caribbean Species.*

S. VINCENTINA E. A. Smith. Pl. 63, figs. 65, 66.

Shell ovate, very thin, pale greenish-corneous, spire obtusely conoid; whorls 3, the first two sculptured with delicate, close, waved striæ, the first whorl involute at the apex; last whorl ample, delicately plicate longitudinally, and transversely *obsoletely* substriate, scarcely descending. Aperture inversely auriform; peristome very thin throughout. Length 13, diam. 10 mill. (*Smith.*)

*St. Vincent, Upper Richmond Valley,* in damp forest, 2000 feet elevation, on leaves of *Artanthe* (*Piperaceæ*). H. H. Smith.

*S. vincentina* SM., Proc. Malac. Soc. i, p. 305, pl. 21, f. 4, 5 (Oct., 1895).

Only a single specimen was collected. The ovate form, rather conical spire, and the peculiar fine sculpture of the two upper whorls, distinguish this form from other species of the genus. (*Smith.*)

I suppose Mr. Smith refers to *spiral* striæ on the first two whorls; if longitudinal striæ are meant, the species would be referable to *Amphibulima*, not *Simpulopsis*.

*Species of Mexico and Central America.*

S. SIMULA (Morelet). Pl. 63, figs. 56, 57.

Shell conic-globose, very thin, somewhat membranaceous, pellucid, elegantly sculptured with slightly oblique longitudinal and rather spaced folds; pale olivaceous-corneous. Spire shortly conoid, the apex rather obtuse; suture impressed. Whorls $4\frac{1}{2}$, a little convex, the earlier two nearly smooth, the last larger than the spire, expanded and inflated. Aperture lunate-rotund, colored within like the outside; peristome simple, concolor, the terminations separated, columellar margin arcuate, thin, basal and outer margins acute. Length 11, diam. 9, length of aperture 7, width 6 mill. (*F. & C.*).

*Peten, northern Guatemala,* in woods, on the leaves of trees (Morelet).

*Bulimus simulus* MORELET, Testacea Novissima ii, p. 11 (1851). PFR., Monogr. iii, p. 383 (1853); iv, p. 450; vi, p. 90.—*Orthalicus* (*Plectostylus*) *simulus* ADS., Genera ii, p. 155 (1858).—*Bulimulus* (*Eudioptus*) *simulus* ALBERS, Die Hel., edit. v. Mart., p. 223.—*Simpulopsis? simula* PFR., Monogr. vii, p. 516 (1876).—*Simpulopsis*

*simula* Fischer & Crosse, Miss. Scient. Mex., Moll., i, p. 578, pl. 24, f. 13, 13a.—Von Martens, Biol. Centr.-Amer., Moll., p. 253.

Resembles the Brazilian species in color and form. It is known by the type lot only, one of which has been figured by Fischer and Crosse.

S. cumingi Pfeiffer. Pl. 63, figs. 61, 62.

Shell subglobose, very thin, lightly and irregularly plicatulate, pellucid, slightly shining, greenish-corneous. Spire minute, projecting as a little papilla. Whorls 3, the last much inflated; columella regularly arcuate, simple. Aperture oblique, rounded-oval, very glossy inside; peristome simple, a little expanded. Alt. 12, greater diam. $20\frac{1}{2}$, lesser $19\frac{1}{2}$ mill. (*Pfr.*).

*Mexico* (Cuming coll.).

*S. cumingi* Pfr., P. Z. S., 1861, p. 27, pl. 3, f. 2; Malak. Blätter, 1861, p. 84; Monogr. v, p. 22; vii, p. 29.—Reeve, Conch. Icon., xiii, pl. 1, f. 5 (1862).—Fischer & Crosse, Miss. Scient. Mex., Moll., p. 580.—Martens, Biol., p. 253.

Known by the original description and Reeve's figures, which represent a shell double the size of *S. ænea*, and distinctly plicatulate.

Section Bulimulopsis Pilsbry, 1899.

*Eudioptus* Albers, Die Hel., edit. Martens, p. 223, 1861 (type *B. pseudosuccineus* Moric.). Not *Eudioptis* Hübner, Verzeichniss bekannter Schmetterlinge, 1816.

Shell smooth, varying from oblong-ovate to globose-conic, imperforate or very narrowly perforate, thin, brittle, translucent, glossy and unicolored; whorls 4 to $5\frac{1}{2}$, the apical $1\frac{1}{3}$–$1\frac{1}{2}$, sculptured with excessively fine, dense, spiral striæ, as in typical *Simpulopsis*. Aperture ovate, the peristome and columella thin and simple. Type *S. pseudosuccinea* Moric.

A Brazilian group of thin, brittle-shelled snails, resembling *Simpulopsis* in their tenuity and simple peristome, but differing in the more Bulimoid form of the shell, which is very smooth and light colored. The soft anatomy is unknown.

*Key to Species.*

*a.* Length of shell over twice its diameter; oblong ovate.

*pseudosuccinea*, p. 221.

$a^1$. Diameter of shell slightly under $\frac{2}{3}$ its length; ovate; whorls 5. *limpida*, p. 223.

$a^2$. Diameter of shell $\frac{2}{3}$ to $\frac{3}{4}$ its length; ovate-conic; whorls 5; periphery rounded. *citrinovitrea*, p. 221.

$a^3$. Diam. of shell over $\frac{3}{4}$ its length; globose conic; whorls 4.

*b*. Brownish-yellow; periphery faintly angular; alt. 11–13 mill. *boissieri*, p. 222.

$b^1$. Alt. 7 mill. *progastor*, p. 223.

S. PSEUDOSUCCINEA (Moricand). Pl. 64, figs. 4, 5.

Shell imperforate, oblong-ovate, *Succinea*-shaped, very thin and fragile. Decidedly translucent, the columella visible through the shell; whitish corneous or faintly yellowish. Surface glossy, with slight growth-wrinkles, nepionic $1\frac{1}{2}$ whorls with excessively fine, close, spiral striation. Spire conic, the apex rather obtuse. Whorls about $5\frac{1}{2}$, moderately convex, with well impressed sutures, the last whorl oblong, tapering above and below, a faintly sketched, hardly noticeable angle traced around the periphery.

Aperture oblique, ovate-pointed, broadly rounded below; lip simple, unexpanded; columella concave below, thread-like, with a faintly convex spiral trend above; basal view showing a narrow "false umbilicus" extending to apex.

Alt. $23\frac{1}{2}$, diam. 11; length of aperture $12\frac{1}{2}$ mill., or smaller.

*Environs of Bahia, Brazil* (Blanchet, v. Ihering).

*Helix pseudosuccinea* MORICAND, Mém. Soc. Phys. et d' Hist. Nat. de Genève, vii, p. 435, pl. 2, f. 18 (1835–6).—*Bulimus pseudosuccinea* DESH. in Lam., Anim. s. Vert. viii, p. 248.—POT. & MICH., Galerie, i, p. 140, pl. 13, f. 5, 6.—PFR., Monogr. ii, p. 148; iii, 302; iv, 450; vi, 89; viii, 125; Conchyl. Cab. p. 216, pl. 60, f. 5, 6.—REEVE, Conch. Icon. pl. 62, f. 429.—*Bulimulus pseudosuccineus* BECK, Index, p. 64.—CLESSIN, Mal. Bl. (n. F.) x, 1888, p. 166.—*Succinea moricandi* PFR., Symbolæ ad Hist. Hel. ii, p. 131.

Much more elongated, and of a more milky tint than *S. citrinovitrea*. As in *S. boissieri*, there is a slightly indicated keel at the periphery. This species is the type of the section *Eudioptus*, and has hitherto been referred to *Bulimulus*. Its affinities, however, are with the following species:

S. CITRINOVITREA (Moricand). Pl. 64, figs. 96, 97.

Shell minutely perforate, *ovate-conic*, thin and *transparent*, the

columella being visible through the last whorl; *pale yellowish-green.* Surface glossy and nearly smooth, having slight growth-wrinkles only. Spire conic, the apex slightly obtuse; suture well impressed; *whorls about 5*, convex, the last well rounded. Aperture broadly ovate, slightly oblique; outer lip thin and sharp; columella slightly concave or nearly straight, thin. No perceptible parietal callus.

Alt. 13, diam. 9, longest axis of aperture 8, width 5.3 mm.

Alt. 16, diam. 10.5, longest axis of aperture 9, width 6.5 mm.

*Environs of Bahia, Brazil* (Blanchet, v. Ihering).

*Helix* (*Cochlogena*) *citrino-vitrea* MORICAND, Mém. Soc. Phys. et d'Hist. Nat. de Genève, vii, p. 436, pl. 2, f. 19 (1835 or 1836).—*Bulimus citrino-vitreus* Mor., PFR., Monogr., ii, p. 149; Conchyl. Cab., p. 218, pl. 60, f. 13, 14.—DESH. in Lam. An. s. Vert., viii, p. 246.—POT. & MICH., Galerie, i, p. 135, pl. 12, f. 13, 14.—*Bulimulus citrino-vitreus* BECK, Index, p. 64.—*Simpulopsis citrino-vitrea* Mor., PFR., Monogr., vii, p. 29.—CLESSIN, Malak. Bl. (n. F.), x, p. 168.—*Bulimus vitrinoides* REEVE, Conch. Icon., pl. 46, f. 290 (1848).

Has a more elevated spire, less inflated contour, and more whorls than *S. boissieri.* It also differs in color. Large specimens are distinctly perforate; but in those of small size, a lens is required to see the minute chink behind and below the columellar reflection.

S. BOISSIERI (Moricand). Pl. 64, figs. 98, 99.

Shell imperforate, *globose*, with short, conic, small spire; very thin, translucent; *brownish-yellow or "tawny."* Surface glossy, smooth except for slight growth-wrinkles, *begirt at the periphery by an inconspicuous cord or angulation.* Spire short, the apex a little obtuse; whorls 4, convex, the last globose. Aperture slightly oblique, rounded-ovate; peristome thin and sharp; columella thin, concave below, straight or slightly sigmoid above, the reflexed callus very thin and adnate.

Alt. 11.3, diam. 9.5, longest axis of aperture 8, width 6 mill.

Alt. 12–13, diam. 10 mill (Moricand).

*Environs of Bahia, Brazil* (Blanchet and others).

*Helix* (*Bulimus*) *boissieri* MORIC., Mém. Soc. Phys. et d'Hist. Nat. de Genève, xi, p. 156, pl. 5, f. 24, 25 (1845 or 1846).—*Bulimus boissieri* Moric., PFR., Monogr., ii, p. 149; Conchyl. Cab., p. 218, pl. 60, f. 15, 16.—REEVE, Conch. Icon., pl. 64, f. 449.—*Simpulopsis boissieri* Mor., PFR., Monogr., v, p. 23.

This species is larger than *S. progastor*, which is evidently closely allied. It is much more ventricose than *S. citrinovitrea*, of different color, has a whorl less, and, on close inspection, is seen to be belted by an angle at the periphery. This is not conspicuous, but is constant in the series before me.

S. PROGASTOR (Orbigny). Pl. 64, figs. 1, 2, 3.

Shell globose, about as high as wide, thin, transparent; amber tinted, slightly brownish, and uniform; smooth, or with merely some traces of growth-lines near the suture. Spire elevated, conic, the apex obtuse; formed of 4 whorls, separated by a quite deep suture. Aperture about as wide as high, oblique, the peristome thin and sharp. Length 7 mill. (*Orb.*).

"*Province des Mines*" *Brazil* (Fontaine).

*Helix progastor* D'ORB., Synops., in Mag. de Zoöl., 1835, p. 2: Voy. dans l'Amer. Mérid., Moll., p. 255, pl. 22, f. 12–15.—*Vitrina progastor* PFR., Monogr. iii, p. 74.—*Succinea progastor* BECK, Index Moll., p. 99.—PFR., Monogr. ii, p. 527.—*Simpulopsis progastor* PFR., Monogr. v, p. 23.

Evidently allied to *S. boissieri*, but much smaller, with about the same number of whorls. I have not seen specimens.

S. LIMPIDA (Drouet). Pl. 63, figs. 69, 70.

Shell imperforate, ovate-ventricose, very thin and very fragile, pellucid, striated, shining, transparent-yellowish. Whorls 5, convex, the last large, swollen. Aperture ample, ovate-pear-shaped; peristome simple, unexpanded, acute. Alt. 13, diam. 8, length of aperture 8, width 5 mill. (*Drouet.*)

*Ilet-la-Mère*, *French Guiana*, on leaves (Eyries).

*Bulimus limpidus* DROUET, Moll. Terr. et d' éau douce de la Guyane Française, p. 64, pl. 2, f. 23, 24 (1859).—PFR., Monogr. vi, p. 108.

"In its pellucid texture and coloration, this pretty and very fragile shell approaches certain Vitrinas." The species is known to me by Drouet's account only. It seems to be either a *Simpulopsis* or a *Drymæus*, some forms of the latter genus, such as *D. dominicus*, being equally fragile and transparent.

Subgenus PLATYSUCCINEA Ancey, 1881.

*Platysuccinea* ANCEY, Le Naturaliste iii, 1881, p. 484. Type *S. portoricensis*.

Similar to *Simpulopsis* in contour, but pallid, not plicate, and with the apex smooth.

I have not examined the apices of *S. ænea* or *S. psidii;* but it is smooth, without spiral striæ, in *S. portoricensis* and *S. dominicensis.* I look upon *Platysuccinea* as a group ancestral to *Gæotis*, and probably differing from the typical forms of *Simpulopsis* in some structural characters besides the difference in the apex; but only a thorough study of the soft anatomy can justify such suspicions.

Antilles: Porto Rico, *S. portoricensis*, *S. psidii.*
Haiti, *S. dominicensis.*
Mexico: *S. ænea.*

S. PORTORICENSIS Shuttleworth. Pl. 63, figs. 67, 68.

Shell semi-oval, ventricose, thin, glossy and nearly smooth, being sculptured with slight irregular growth-wrinkles, stronger near the aperture; somewhat translucent, very pale straw-tinted. Spire prominent; whorls about $2\frac{1}{2}$, very rapidly increasing and very convex, the suture deeply impressed; last whorl ventricose. Aperture rounded-oval, very oblique; peristome thin; columella regularly arcuate, thin.

Alt. 12.6, diam. 13 mm.

Alt. 12, diam. 15 mm.

*Sierra de Luquillo, Porto Rico,* abundant on banana leaves (Blauner).

*S. portoricensis* SHUTTL., Diagn. n. Moll., in Mittheil. der Naturforschenden Gesellschaft in Bern, 1854, p. 55 (separate copies, p. 147).—PFR., Monogr. iv, p. 801; v, p. 22.—CROSSE, Journ. de Conchyl. 1892, p. 22.—*Platysuccinea portoricensis* ANCEY, Le Naturaliste, iii, 1881, p. 484.

Evidently allied to the smaller, less elevated, *S. dominicensis.* It has not been figured before.

S. PSIDII (Martens). Pl. 63, figs. 63, 64.

Shell imperforate, globose-conoid, thin, shining, striatulate, pale buff. Whorls 3, a little convex, forming a conic spire with obtuse apex; the last whorl inflated below. Aperture oblique, lunate-circular, occupying two-thirds the total length of the shell; upper margin somewhat straightened, produced in a sigmoid curve; columellar margin thin, a little arcuate. Alt. 5, greater diam. 5, lesser 4, oblique alt. of aperture $3\frac{1}{4}$, width 3 mill. (*Mart.*).

*Caguana, near Utuado, Porto Rico*, on leaves of Gujave trees, Psidium piriferum and pomiferum (Gundlach & Krug).

*Bulimus* (*Eudioptus*) *psidii* MARTENS, Jahrb. d. D. Malak. Gesell.. iv, 1877, p. 351, pl. 12, f. 6.

"I am not at all certain that the specimens before me are completely mature, but neither do I know of any Portorican species which they could be considered the young of. There are several specimens of the same size, and both Gundlach and Krug assert that they are not the young of any other species" (*Martens*).

The far smaller size, with the same number of whorls as *S. portoricensis*, indicates that this is not the young of that form. Though not hitherto referred to *Simpulopsis*, it is evidently congeneric with *portoricensis*.

S. DOMINICENSIS Pfeiffer. Pl. 63, fig. 75.

Shell globose, with short, conic spire and large, oblique body-whorl, smooth except for some slight growth-wrinkles, and faint transverse impressions on the last whorl, glossy, pale yellow, very thin, and when not adult extremely fragile. Whorls $3\frac{1}{3}$, convex, separated by deeply impressed sutures, the last whorl rotund. Aperture quite oblique, rotund, slightly excised by the penultimate whorl; columella arcuate above, sloping below, thin. Alt. 6.4, diam. 7 mill.

*Haiti: Sans-souci* (Rolle) *Santo Domingo, Mt. Diego Campos* on leaves of palms (Hjalmarson); *San Cristobal* (Sallé); *Santa Domingo* without exact locality (Gabb).

*S. dominicensis* PFR., Malak. Bl., 1858, p. 146; Monogr. iv, p. 802; v, p. 23.—CROSSE, Journ. de Conchyl., 1891, p. 127.—*Vitrina* ?, HJALMARSON, Malak. Bl., v, 1858, p. 146.

The specimen figured was collected by Gabb. The young are very fragile and pellucid, with the texture of *Vitrina*. The altitude "3 mill." assigned by Pfeiffer must be a mistake, possibly from misreading the scale.

S. ÆNEA Pfeiffer. Pl. 63, figs. 58, 59, 60.

Shell conic-globose, thin, very closely striated, pellucid, with bronze reflections, olivaceous-corneous. Spire short, slightly conic, the apex rather obtuse, roseate; suture impressed. Whorls $2\frac{1}{2}$, at first convex, the last inflated. Aperture oblique, oval, glossy and

whitish within; peristome simple, unexpanded, the margins joined by a very thin whitish callus; columellar margin thread-like, basal and outer margins acute. Alt. $5\frac{1}{2}$, diam. maj. 9, min. 8 mill. (*F. & C.*).

*Parada, State of Oaxaca, Mexico* (Sallé).

*Simpulopsis ænea* Pfr., P. Z. S., 1861, p. 27; Malak. Bl., viii, 1861, p. 84; Monogr. Hel. Viv. v, p. 22; vii, p. 29, 516.—Reeve, Conch. Icon. xiii, pl. 1, f. 7 (1862).—Fischer & Crosse, Miss. Scient. Mex., Moll., p. 580, pl. 24, f. 12.—Martens, Biol. Centr. Amer., Moll., p. 253.—*Succinea ænea* Martens, Malak. Bl., xii, 1865, p. 70.

The sculpture is of very fine, crowded striæ, hardly visible with the naked eye. Only the original specimens collected by Sallé are known.

*Doubtful and spurious species, referred to Simpulopsis.*

S. salomonia (Pfeiffer). Pl. 63, figs. 76, 77, 78.

Shell globose-conic, very thin, closely obliquely plicate, pellucid, shining, brownish-olivaceous. Spire conic, a little obtuse; suture impressed. Whorls 4, a little convex, the last about three-fifths the total length of the shell. Aperture oblique, oval; peristome simple, unexpanded, the margins regularly arcuate. Alt. 11, diam. 9 mill.; aperture $8\frac{2}{3}$ mill. long, 6 wide (*Pfr.*).

"*Salomon's Islands*" (Cuming coll.).

*Vitrina salomonia* Pfr., Zeitschr. f. Malak. 1853, p. 51; Monogr. Hel. Viv., iii, p. 623.—*Simpulopsis salomonia* Pfr., Conchyl Cab., p. 29, pl. 6, f. 17–19.—*S. salomonis* Pfr., Albers, Die Hel. edit. v. Martens, p. 309.

Has the appearance of a Brazilian shell, and possibly the locality is erroneous. If really from the Solomon Islands it will probably prove to belong to the *Zonitidæ*. Gray referred the species to *Helicarion*.

S. angularis (Férussac). Pl. 63, figs. 71, 72.

Férussac's figure represents a globose-conic shell somewhat like *S. dominicensis* in form, but with the last whorl angulated around the periphery (as in *S. boissieri*, but more strongly). It is thin, striate, olivaceous, with about 4 whorls. Alt. 10, diam. 12 mill.

*Isle of France* (?).

*Helix* (*Cochlohydra*) *angularis* Fer., Prodr. p. 27; Hist. p. 11A, f. 5.—*Vitrina angularis* Gray, Ann. of Philos., 1825, ix, p. 415.—Pfr., Monogr. ii, p. 512.—*Succinea angularis* Pfr., Symbolæ, ii, p. 131.—*Simpulopsis angularis* Beck, Index, p. 100.—Pfr., Monogr. v, p. 22.

Locality uncertain; and the species has not been rediscovered by post-Férussacian conchologists.

Simpulopsis colmeiroi Hid., Miller, Mal. Bl. xxv, 187, is a *Drymæus*. See *Manual*, vol. xi, p. 316.

S. mastersi Brazier (P. Z. S., 1872, p. 619; Lord Howe's Island), is a *Flammulina*. See Man. Conch. ix, p. 18, and viii, p. 294; Rec. Austr. Mus. i, 1891, p. 140.

S. fulgurata Miller. Pl. 63, figs. 73, 74.

Shell succinoid, imperforate, very thin, shining, striate and decussated by very minute elevated lines; tawny, ornamented with oblique brown streaks, zigzagged above; spire short, conic, the apex obtuse; whorls $3\frac{1}{2}$, planulate, the first two rudely punctate, the last ventricose, forming two-thirds the entire alt. Columella simple, strongly twisted, visible within to the apex, spirally ascending; arcuately passing into the basal lip. Aperture very oblique, oval, angular above; peristome simple, acute. Length 18, diam. 13, aperture 14 mill. long, 10 wide (*Miller.*)

*Pilaton Valley, Ecuador*, in woods in the very moist region, on leaves, over 1000 meters elevation (Boetzkes).

*S. fulgurata* Mill., Malak. Blätter, xxv, 1878, p. 187; (n. F.) i, pp. 185, 201, pl. 6, f. 6, *a*, *b*. *Cf.* Dohrn, Jahrb. D. M. Ges. 1879, p. 188.

Dohrn has already referred this supposed species to *Eurytus*. It is undoubtedly the young of some lightning-streaked species of that group.

## Genus GÆOTIS Shuttleworth, 1854.

*Gæotis* Shuttl., Mittheil. der naturforsch. Gesell. in Bern, 1854, p. 34.—Pfeiffer, Monogr. Hel. Vivent. v, p. 10 (1868).—Binney & Bland, Ann. Lyc. Nat. Hist. of N. Y., x, p. 252 (jaw and dentition).—W. G. Binney, Ann. N. Y. Acad. Sci. iii, p. 116 (jaw and dentition).

Animal large, depressed, with very broadly dilated, flattened foot;

tentacles as usual; mantle partially covering the shell, having an appendage posteriorly on the right side.

Shell sigaretiform, fragile and pellucid, composed of about $2\frac{1}{2}$ whorls, the spire flat and near the right side, the apical whorl smooth. Lower surface completely open, the margin of the last whorl membranous, not calcified, the columella a spiral lamina along the suture.

Jaw long and low, composed of numerous narrow plaits, as in *Drymæus*, *Amphibulima*, etc.

Radula with the transverse rows of teeth arranged *en cherron;* centrals with long and narrow basal plate, and a gouge-shaped, trilobed cusp, situated far back on the basal plate. Side teeth similar, but larger; somewhat asymmetrical, the median cusp of the trilobed gouge much smaller than the side cusps.

The shell of *Gæotis* is like that of *Peltella* and *Cryptostrakon;* the jaw is similar to that of *Peltella*, *Amphibulima* and *Drymæus;* but the radula has peculiar teeth, with some resemblance to those of the *Orthalicinæ* and *Polymita*, and as in those genera, correlated with arboreal habits. The marginal teeth of *Amphibulima*, and especially of the subgenera *Pellicula* and *Rhodonyx*, are considerably like the teeth of *Gæotis*, and show its close relationship with those groups.

The character of the radula peremptorily forbids a union of *Gæotis* with *Peltella* or *Cryptostrakon*. While there can be little doubt that it is allied to *Peltella*, *Pellicula*, *Amphibulima* and *Simpulopsis*, especially the subgenus *Platysuccinea*, the exact relationships of these genera remain unknown, awaiting a comparison of their soft anatomy.

*Gæotis* lives on the trunks and leaves of trees, especially bananas. It is doubtless a vegetable eater. The species now known are all from Porto Rico.

Shuttleworth has adopted the plan of measuring the altitude obliquely, as when the shell is placed concave side down on a flat surface. This is more properly called the *convexity*. I have followed his method, as the altitude cannot readily or certainly be measured in the ordinary way.

The soft parts will doubtless give more satisfactory specific characters than the shells, though the species described so far are not difficult to distinguish. None of them have been figured hitherto. The radula and jaw are known by Mr. W. G. Binney's researches, but nothing is known of the rest of the anatomy.

*Gæotis douvillei* de Morgan (Bull. Soc. Zoöl. de France, x, p. 388,

pl. 8, f. 9, 1885), from the summit of mount Tchabang, Perak, is doubtless a *Girasia* allied to *G.* (*Africarion*) *ater* Godwin-Austen.

G. NIGROLINEATA Shuttleworth. Pl. 62, figs. 41, 42, 43, 44.

Shell very much depressed, very thin, hyaline-glassy, somewhat opalescent, shining; striated with flexuous growth lines, obsoletely decussated with spirals. Spire minute, flat, scarcely papillar; whorls $2\frac{1}{2}$, very rapidly widening, the last large, depressed; suture margined. Aperture very oblique; peristome with the right margin sinuously produced, the basal margin with a broad membranous margin. Alt. about $3\frac{1}{2}$, greatest diam. 12, lesser 9 mill.

Animal pale greenish-buff, pellucid, ornamented with very fine black lines. Liver a vivid and deep rust color.

*Sierra de Luquillo*, *Porto Rico*, on banana leaves, abundant (Blauner); *Humacao* (Bland).

*G. nigrolineata* SHUTT., Mittheil. naturforsch. Gesell. Bern, 1854, p. 35; Diagnosen neuer Moll., p. 127.—PFR., Monogr. v, p. 11.—CROSSE, Journal de Conchyl. 1892, p. 21.

This species is very much depressed and very fragile, with the spiral cords almost obsolete.

G. FLAVOLINEATA Shuttleworth.

Shell depressed, very thin, hyaline-glassy, shining, somewhat opalescent, with flexuous growth-lines and spirals obsoletely decussating them; spire very minute, flat; whorls $2\frac{1}{2}$, very rapidly increasing, the last large, somewhat inflated and obtusely subangulate, depressed in front; suture margined, obsoletely crenulate-crispate. Aperture very oblique; peristome with the right margin flexuous, basal and columellar margins with a very broad membranous margin. Alt. 6, greatest diam. 19, lesser diam. 14 mill.

Animal large, ornamented with very fine yellow lines.

*Sierra de Luquillo and at Rio Blanco, Porto Rico*, very rare on trunks and leaves of the Banana (Blauner); *between Arecibo and Utuado* (Gundlach & Krug).

*G. flavolineata* SHUTT., l. c. p. 35; Diagn. p. 127.—PFR., Monogr. v, p. 11.—v. MARTENS, Jahrb. D. mal. Ges. iv, 1877, p. 353.—CROSSE, Journ. de Conchyl., 1892, p. 22.

I have not seen this species, which differs from *G. nigrolineata* in its somewhat greater convexity, larger size and subangulate last whorl.

G. MALLEATA Pilsbry, n. sp. Pl. 62, figs. 36, 37, 38, 39, 40.

Shell intermediate between *G. nigrolineata* and *G. albopunctulata*, more convex, larger and more solid than the former, decidedly more flattened above than the latter species. Milky-translucent, the very thin cuticle with a faint yellowish tint; apex a trifle projecting; whorls about $2\frac{1}{2}$, the suture margined, *its last half turn far more widely deviating than in G. nigrolineata*, being much as in *G. albopunctulata*, but less descending. Surface with irregular growth-wrinkles, numerous superficial spiral cords, and *a generally distributed fine malleation*, oblique in the peripheral region. Periphery well rounded; baso-columellar margin with a broad membranous edge; cavity of the spire well open; peristome narrowly brown-edged. Convexity 3.7, length 13, breadth 9.7 mill.

*Near San Juan, Porto Rico* (Robert Swift).

Differs from *G. nigrolineata* in the malleated surface and deviating suture. *G. flavolineata* is described as larger, with obtusely subangulate last whorl and decussated surface. *G. albopunctulata* is much more globose and solid, but has much the same sculpture.

G. ALBOPUNCTULATA Shuttleworth. Pl. 62, figs. 45, 46, 47, 48.

Shell rather solid, opalescent-whitish, covered with a very thin epidermis; plicatulate with flexuous growth-lines, decussated and in a manner obsoletely wrinkle-malleated by somewhat crispate spirals; spire minute, very shortly papillar; whorls $2\frac{2}{3}$, very rapidly widening, a little convex, the last whorl large, inflated, quite rotund, descending in front, depressed and deflexed; suture margined, somewhat crenulated. Aperture very oblique; peristome with the right margin flexuously produced forward, basal and columellar margins with a membranous margin. Alt. 8, greatest diam. 19, lesser diam. 14 mill.

Animal large, pellucid, white, spotted with opaque white dots. Liver pale greenish.

*Humacao, Porto Rico*, on tree trunks, very rare (Blauner).

*G. albopunctulata* SHUTTL., l. c., p. 36.—PFR., Monogr. v, p. 12. —CROSSE, Journ. de Conchyl., 1892, p. 22.

Larger, more solid, and decidedly more globose than the other species, with the cavity of the apex more concealed. The sculpture is also somewhat stronger, though the malleation is not clearly visible without a lens. The suture deviates far more than in *G. nigro-*

*lineata*. The specimen figured measures: convexity or oblique alt. 5.5, length 14.7, breadth 10.5 mill. The suture is hardly margined and there are $2\frac{1}{2}$ whorls. It is from the type locality.

## Genus PELTELLA Webb & Van Beneden, 1836.

*Peltella* W. & B., in Guérin's Mag. de Zoöl., cl. v, text for pl. 75 and 76 (1836).—Von Ihering, Malak. Blätter (n. F.), viii, pp. 57–81 (1886); also Archivos de Mus. Nac. Rio de Janeiro, viii, pp. 135–153. (Anatomy and systematic position.)

*Pectella* Gray, P. Z. S. 1847, p. 171.

Slug-like, the foot spreading at the sides, weakly reticulated, with some grooves running forward from the mantle, the tail without pore, not keeled, sole scarcely tripartite; mantle region elevated or humped, the mantle large, chiefly behind the middle, perforated in the middle by a small oval slit; the breathing pore in front of the middle; anus opening into a wide anal sack.

Genitalia simple, opening below the right eye-tentacle.

Retractor muscle system consisting of a very short columellar muscle branching into three subequal bands, the median one buccal, the right and left bands tentacular, and each with a group of foot retractor muscles.

Jaw horse-shoe shaped, thin, with many narrow converging plates. Radula substantially as in the normal forms of *Drymæus*.

Shell mainly cuticular, Haliotiform, depressed, squarish-oval, with about $1\frac{3}{4}$ whorls, the spire small, flat and lateral; open below, the columella represented by a spiral lamina along the suture.

Type *Parmacella palliolum* Fér. Brazil.

Dr. H. von Ihering, who has given an excellent account of this genus, correctly locates it in the *Bulimulidæ*. The sculpture of the apical whorl is unknown. If spirally striated, the descent of the genus from *Simpulopsis* would be indicated.

P. palliolum (Férussac). Pl. 62, figs. 32, 33, 34, 35.

Animal, preserved in alcohol (fig. 32), measuring 50 mill. long, 15 wide, 13 high. Foot broadly expanded laterally, rounded dorsally behind the mantle, not keeled or regularly grooved; no caudal mucous pore. Sole only feebly tripartite. Genital opening below the right eye-tentacle. Mantle rather large, 21 mill. long, 13 wide, mainly on the posterior half of the body; a longitudinal slit 2 mill. long in the middle, exposing the shell.

Shell depressed, somewhat squarish oval, green, but slightly calcified, the cavity open beneath. Whorls not quite 2, the small spire lying on the right side rather far posteriorly. Length 18, breadth 10, height 5 mill.

*Brazil* (Taunay); *Tijura*, near Rio de Janeiro (von Ihering), on a banana.

*Parmacella palliolum* Férussac, Prodr., Tabl. Syst. de la famille des Limaces p. 25 (1821); Histoire, pl. 7 A, f. 1–9.—*Peltella palliolum* von Ihering, Malak. Blätter (n. F.), viii, p. 57–81, pl. 3, 4 (anatomy); x, p. 168; Descripcoa e anatomia da Peltella, in Archivos do Museu Nacional do Rio de Janeiro, viii, 1892, pp. 135–153, pl. 7, 8.

The open spiral of the shell is similar to those of *Cryptostrakon* and *Gæotis*. The species is known from the original account by Férussac, and an excellent anatomical description by Dr. H. von Ihering.

## Genus CRYPTOSTRAKON W. G. Binney, 1879.

*Cryptostrakon* W. G. B., Annals of the New York Acad. of Sci., i, p. 258; iii, p. 104. Type *C. gabbi* W. G. B.

*Cryptostracon* Fischer, Manuel, p. 469.—Tryon, Man. of Conch. (2), i, pp. 233, 249.

See Tryon, Manual of Conchology, i, p. 249.

In this slug the shell agrees with *Peltella* and *Gæotis*. It is said to be wholly enclosed, but this may possibly be erroneous. The jaw is described as solid with a few stout ribs; and the radula is decidedly of Helicid type, being that of a ground snail. There is thus no question that *Cryptostrakon* differs generically from *Peltella* and *Gæotis*, and the probabilities are that it groups with *Xanthonyx* (Fischer and Crosse) and *Metastracon* (Pilsbry, 1899), rather than with the preceding Bulimulid genera. This can only be determined by an examination of the genitalia.

## Genus AMPHIBULIMA Lamarck, 1805.

*Amphibulima* Lam., Annales du Muséum d'Histoire Naturelle, vi, p. 304 (for *A. cucullata*, *A. succinea*, *A. oblonga*).—Beck, Index Moll. p. 98 (for *A. unguis*, *gayana*, *tigrina*, *patula*, *rubescens*, *macrostoma*).—Gray, P. Z. S., 1847, p. 171 (type *A. cucullata*).—*Amphibulina* Gray, Synops. Brit. Mus., 1842, p. 90.—*Amphibulimus*

MONTFORT, Conch. Syst. ii, p. 90 (for *A. cucullatus*).—*Brachyspira* PFR., Mal. Bl. 1855, p. 117; Mon. Hel. Viv. iv, p. 804.—MARTENS in Alb., Die Hel., 1860, p. 311 (type *S. tigrina* Les.)

Shell *Succinea*-shaped, with less than 3 whorls, sculptured with growth-wrinkles and more or less obvious spiral impressions or cords; columella distinct, not reduced to a spiral ridge, which exposes the interior of the spire. Apical $1\frac{1}{2}$ whorls finely wrinkled longitudinally, the wrinkles waved, sometimes anastomosing to form a network or quasi-punctulation, and usually slightly cut by spiral lines on the latter part of the last nepionic whorl (this sculpture obsolete in some forms).

Soft parts externally about as in *Bulimulus*, except for the degeneration of the mantle. Jaw thin, composed of many narrow plaits, as in *Drymæus*. Radula with the mesocones prominent and broad, blunt or pointed. Genitalia simple, as usual in *Bulimulus* and *Drymæus*.

Type, *A. patula* Brug. Distribution, Caribbean Islands.

The shell is capable of containing the soft parts in the typical forms, but not in the subgenus *Pellicula*. It closely resembles *Succinea* in form, and the species were formerly referred to that genus. The researches of Dr. Paul Fischer and Mr. W. G. Binney have demonstrated the Bulimulid organization of all the main species of the group, and malacologists now agree upon the systematic position of *Amphibulima* as a genus of *Bulimulidæ*.

*Omalonyx* (*Homalonyx* of some authors), a genus of *Succineidæ*, has a shell closely resembling that of *Pellicula*, a subgenus of *Amphibulima*. In genera with the shell degenerate, it is practically impossible to frame generic diagnoses which shall be really diagnostic. *Rhodonyx* can scarcely be so defined conchologically as to distinguish it from some forms of *Succinea; Pellicula* is equally impossible to distinguish from *Omalonyx* or some Polynesian *Succineidæ;* and *Gæotis*, *Peltella*, *Cryptostrakon* and some forms of *Girasia* have shells so similar as to almost defy any attempt at differentiation, though the soft parts show broad distinctions.

*Amphibulima imbricata* Rochebrune, Bull. Soc. Philomathique de Paris (7), vi, 1881–2, p. 72, is apparently a *Succinea*.

*Key to subgenera and species.*

*A.* Shell with colored cuticle, streaked or spotted; spire small but projecting. *Amphibulima* s. str.

*b*. Last whorl conspicuously shouldered; width of shell two-thirds its length or more; more than three whorls.

*A. patula*, p. 234.

*b*¹. Shell ovate or oblong, spotted, not shouldered; narrower; less than 3 whorls.

*c*. Very thin and fragile or flexible; corneous or greenish, with reddish dots, outer lip regularly arcuate, not sinuate; spire very short:

St. Vincent, *A. tigrina*, p. 237; Dominica, *A. pardalina*, p. 237.

*c*¹. Thin but not fragile or flexible; outer lip sinuated; colored like the last; spire slender, between $\frac{1}{4}$ and $\frac{1}{5}$ the length of shell; Dominica, *A. browni*, p. 238.

*c*². Thin, dark horn-colored with very few reddish dots; outer lip slightly sinuous; Montserrat.

*A. rawsonis*, p. 239.

*B*. Shell regularly *Succinea*-shaped, pellucid, uniform rose corneous, the spire projecting, apical $1\frac{1}{2}$ whorls wave-wrinkled, whorls $2\frac{3}{4}$. S.-g. *Rhodonyx*. *A. rubescens*, p. 240.

*C*. Shell much depressed, the spire very small, scarcely projecting above the vertex of the last whorl, apical whorl smooth; whorls less than two; columella with a more or less developed blade-like process; aperture about as long as the whole shell. S.-g. *Pellicula*.

*a*. Spire a trifle projecting above the posterior border of the lip; columellar appendage well developed.

*A. appendiculata*, p. 241.

*a*¹. Spire sunken or hardly projecting; columellar appendage less developed. *A. depressa*, p. 242.

A. PATULA (Bruguiere). Pl. 61, figs. 14–19.

Shell thin but rather solid, Succinea-like, with the latter half or third of the broad last whorl square-shouldered, flattened above; the preceding portion not shouldered but steeply sloping, slightly convex. Spire short, conic, red or maroon, rarely yellow; the last whorl yellowish olivaceous, with finely zigzagged or dotted streaks of opaque yellow. Surface with low, irregular wrinkles of growth, and a close, rather fine sculpture of very irregularly anastomosing spiral cords, obliquely descending on the lower portion, the first $1\frac{1}{2}$ whorls finely

wrinkled. Whorls $3\frac{1}{2}$. Aperture quite oblique, squarish; columella arcuate.

Alt. 26, diam. 18, longest axis of aperture 24 mill. (Guadelupe).

Alt. 33, diam. 20, longest axis of aperture 29 mill. (Marie-Galante).

Alt. 33, diam. 22.5, longest axis of aperture 30 mill. (Dominica).

Alt. 24, diam. 18.5, longest axis of aperture 22 mill. (Dominica).

Alt. 27, diam. 24, longest axis of aperture 25.5 mill. (St. Kitts).

Alt. 21, diam. 15, longest axis of aperture 20 mill. (Saba).

*Guadelupe* (dead specimens only); Sainte-Anne, Bois du Boivin (L'Herminier); "Gosier," on the shore of fort Union, at the mouth of the river Grande Bais (Schramm, Beau). *Marie-Galante*, in the mountainous part, under large stones in a ravine deeply shaded by banana trees (Mazé).

*Dominica* (Guppy, Sharp, Ramage); from Laudat, 2000 ft. elevation, to the sea (Angas); Laudat, on bananas (A. D. Brown).

*St. Kitts:* Bayford's estate, on the wild plantain which grows on the banks of a small water-course (Swift, Dr. Branch).

*Saba* (F. Ober, 1880).

*Bulimus patulus* Brug., Encycl. Meth. i, 1792, p. 305 (Guadelupe).—*Helix patula* Wood, Index Testac. Suppl., pl. 7, f. 9 (bad).—*Succinea patula* Sowerby, A Conchological Manual, p. 4, f. 266 (1839).—Pfeiffer, Monographia Heliceorum Viventium, ii, p. 532; iii, p. 21; vi, p. 26; Zeitschr. f. Malac. 1849, p. 112.—Desh. in Fér., Histoire, ii, p. 140.—Schramm, Journ. de Conchyl. xxi, 1873, p. 127 (occurrence in Guadelupe).—Sowerby, in Conchologia Iconica xviii, pl. 3, f. 21 (1872).—*Amphibulima patula* Beck, Index Moll., p. 98 (1837).—H. & A. Adams, Gen. Rec. Moll., ii, p. 129, pl. 73, f. 3.—Guppy, Ann. & Mag. N. H. (4), i, 1868, p. 432 (in Dominica).—Bland, Journ. de Conchyl. 1873, p. 342 (resumé of geographic distribution).—Fischer, Journ. de Conchyl. xxii, 1874, p. 141–145, pl. 5, f. 8–12 (external form, jaw, radula and genitalia of a Guadelupe specimen).—Maze, Journ. de Conchyl. 1876, p. 394 (living on Marie-Galante); Journ. de Conchyl. 1877, p. 347 (habits); Journ. de Conchyl. 1883, p. 22 (Guadelupe), p. 49 (Marie-Galante).—Bland & Binney, Amer. Journ. Conch. vii, 1871, p. 186, pl. 17, f. 1, 2 (dentition of a Dominican specimen).—Bland & Binney, Ann. Lyc. Nat. Hist. of New York, x, p. 223, 225 (occurrence in St. Kitts).—W. G. Binney, Proc. Acad. N. S. Phila., 1874, p. 44 (dentition).—W. G. Binney, Ann. New York Acad.

Sci. iii, 1884, p. 117, pl. 15, f. E (jaw), pl. 13, f. C, D (teeth), Dominica specimen; also pl. 13, f. A. B (teeth of a St. Kitts specimen). A. D. BROWN, Amer. Naturalist, xv, 1881, p. 57 (Dominica).—ANGAS, P. Z. S. 1883, p. 595, fig. 1 (living animal; Dominica).—E. A. SMITH, Ann. and Mag. N. H. (6), ii, 1888, p. 231 (Dominica).—*Helix* (*Cochlohydra*) *patula* FER., Prodr. no. 7; Histoire pl. 11, f. 14–16.

*Amphibulima cucullata* LAM., Ann. du Muséum, vi, p. 305, pl. 55, f. 4 (1805).—*Amphibulimus cucullatus* MONTFORT, Conchyl. Syst. p. 91, genus 23 (1810).—*Succinea cucullata* LAM., Anim. s. Vert. vi, pt. 2, p. 134 (1822); edit. DESHAYES, viii, p. 315 (1838) (Guadelupe); edit. 3d, Desh. et Milne-Edw., iii, p. 382 (1839).—*Succinea* (*Amphibulima*) *cucullata* BLAINVILLE, Man. de Malac., p. 455, pl. 37, f. 2 (1825).—SOWERBY, Genera of Shells, *Succinea*, f. 1.—*Helix* (*Amphibulima*) *cucullata* SCHWEIGGER, Handbuch der Naturgeschichte des skelettlosen ungegliederten Thiere, p. 741 (1820).—REEVE, Conch. Syst. ii, p. 89, pl. 180, f. 1 (1842; plate reprinted from Sowerby's Genera).

A very easily recognized species, quite unlike any other. The young (pl. 61, fig. 19) are regular in form, like a globose *Succinea*, and are irregularly bestrewn with small reddish-brown spots and streaks, with some yellow streaks.

The foot is comparatively large, and when active, in humid places, the soft parts are probably not completely retractile into the shell. When immersed in preserving fluids they retract completely, probably by parting with some of the water which inflated them; and in dry weather the living animal sometimes retracts entirely within its shell.

The snail is most frequently found on banana leaves, especially those near the ground. It occurs also in the damp cavities of hollow trees, and under the leaves of *Dieffenbachia seguine*. They are immobile during the warm hours of the day, and wander abroad toward evening, seeking food along the water's edge, eating the leaves of *Lepidium virginicum* L., and *Sinapis lanceolata* D. C. They eat lettuce freely in captivity.

The type locality is Guadelupe; but upon the main island the species is now extinct, according to Mazé. It survives on Marie-Galante, and the specimens from Beau which I have figured (pl. 61, figs. 14, 15) are doubtless from the latter island. I can detect no difference

between the fossil form of the main island and these Marie-Galante shells.

In Dominica the species is not uncommon (figs. 16, 17, 18). The shell is more strongly sculptured with spiral decurrent wrinkles or malleation than in Guadelupe, and the color is somewhat deeper. Mr. Binney has also found some small differences in the dentition; and it will probably be best to distinguish the local variety by the name var. *dominicensis*.

In St. Kitts the shells are weakly sculptured, as in those from Guadelupe; there is much less red in the coloring than in the Dominican form. I do not see that they have any varietal features.

In the island of Saba, Ober collected a small form, not differing, except in size, from those of St. Kitts.

A. TIGRINA (Lesueur). Pl. 61, figs. 24, 25.

Shell oval, pellucid, very thin, somewhat greenish, with small scattered reddish spots. Aperture very large, ovate; spire very short.

The shell is very much depressed and somewhat patelliform, the spire consisting of $1\frac{1}{2}$ whorls. The last whorl is almost open, the enclosed portion being very small. The shell is exceedingly thin, finely striated with growth-lines; it is amber-yellow, and bestrewn with little rounded russet spots. Length 18, width 11 mill.

*Island of St. Vincent.*

*Helix* (*Cochlohydra*) *tigrina* Lesueur, FERUSSAC, Prodr., p. 26; Histoire, pl. 11 A, f. 4.—*Succinea tigrina* GRAY, Ann. of Philos., ix, 1825, p. 415.—DESH. in Encycl. Méth., ii, p. 19; in Fer. Hist., ii, p. 140; in An. s. Vert. viii, p. 320.—PFR., Monogr. ii, p. 530; iii, p. 21; v, p. 26.—*Amphibulima tigrina* BECK, Index Moll., p. 98. —E. A. SMITH, Proc. Malac. Soc. Lond. i, p. 307.

The above description is from Deshayes, the figures from Férussac. Other authors have added nothing to this characterization of the species.

My reason for retaining *tigrina* as distinct from *pardalina* is that the number of whorls is less—$1\frac{1}{2}$ instead of $2\frac{1}{2}$—and there is no mention of spiral sculpture by Deshayes. No *Amphibulima* has been found on St. Vincent by later collectors.

A. PARDALINA Guppy. Pl. 61, figs. 20, 21, 22, 23.

Shell long-ovate, *Succinea*-shaped, with *very short, obtuse spire;*

greatest width of shell below the middle of its length; *extremely thin and somewhat flexible;* corneous, clouded with opaque yellow, and sparsely dotted with russet. Whorls $2\frac{1}{2}$, the suture of the first but little descending, but on the latter half of the last it falls steeply. Last whorl convex below the suture, then rather compressed laterally, with faint sculpture of slight, irregular growth-lines and *numerous coarse, very low spiral cords.* Aperture very large, acutely angular posteriorly, at least four-fifths the total length of the shell, ovate; *outer lip regularly arcuate*, a little retracted toward the upper insertion.

Alt. 15, diam. 9.5, length of aperture 13, width 7.3 mill.

Alt. 13.5, diam. 8, length of aperture 10.5, width 7 mill.

*Island of Dominica*, living buried in thick moss on trees in the higher region of the forest, where the vegetation is always dripping with moisture (Guppy).

*Amphibulima pardalina* Guppy, Ann. & Mag. Nat. Hist. (4), i, 1868, p. 432.—*Succinea pardalina* Pfr., Monogr. vii, p. 34.

*Amphibulima tigrina* Les., E. A. Smith, Ann. and Mag. N. H. (6), ii, 1888, p. 231.—Angas, P. Z. S., 1883, p. 595.

*A pardalina* is considered by many authors a synonym of *A. tigrina.* The latter species, if distinct from *pardalina*, is not known to modern collectors and authors; but I do not unite the two because *A. tigrina* is described as having but $1\frac{1}{2}$ whorls, and no spiral sculpture is mentioned, while *A. pardalina* has at least $2\frac{1}{2}$ whorls, and coarse though very low spirals.

Guppy's original description of *pardalina* is as follows: Shell long-oval, *Succinea*-like, thin, flexible, diaphanous, lightly decussated, marked with tawny; whorls 3; spire small, obtuse; aperture ample, dilated in front; peristome simple, inflexed above; suture descending. Length 20, width 11, height of spire 3, width of aperture 9 mill.

The specimen figured was collected by Dr. B. Sharp. Fig. 23 is enlarged to the same scale as fig. 31, and drawn by camera lucida. The nepionic shell is smooth in the specimens I have seen.

A. browni Pilsbry, n. sp. Pl. 61, figs. 28, 29, 30, 31.

Shell oblong, thin, but not elastic or fragile, corneous-olivaceous, with numerous irregularly scattered reddish dots. Surface somewhat wrinkled with growth-striæ and showing numerous very low but coarse irregular spirals. Whorls $2\frac{1}{2}$, the apex decidedly raised; the suture

of the last half whorl rapidly descending. Spire rather slender, its length contained $4\frac{1}{2}$ to $4\frac{3}{4}$ times in that of the shell. Aperture large, irregularly oblong, the outer lip somewhat blunt, strongly arcuate above, retracted or waved backward at the position of the slight "shoulder"; somewhat effuse below. Columella arcuate, thin.

Alt. 19, diam. 10.5, length of aperture 15, length of spire 4.3 mill.

Alt. 18.5, diam. 10, length of aperture 14.7, length of spire 3.8 mill.

*Dominica*, 1,000 ft., on bananas (A. D. Brown).

*A. tigrina* Lesseur, A. D. Brown, American Naturalist, xv, 1881, p. 57.

Less fragile than *A. pardalina*, with less obtuse apex and irregularly arcuate outer lip, which curves transversely at the posterior insertion, and is waved backward where the arcuate upper arc joins the straighter outer portion. The nepionic shell is very finely longitudinally wrinkled, the wrinkles slightly decussated by spiral lines.

A. rawsonis Bland.

Shell ovate-oblong, thin, with rather rib-like striæ irregularly decussated by impressed lines parallel with the suture; shining, scarcely pellucid, rather dark horn-colored, ornamented with a very few reddish spots. Spire short, rather obtuse, rufous; with a reddish line beneath the impressed suture. Whorls 3, the last convex, much deflexed at the aperture; columella callous, receding. Aperture oblique, oblong-oval, coerulescent within; peristome simple, slightly thickened, right margin sinuous, columellar margin arcuate. Length 18, diam. 10 mill.; aperture 14 mill. long, 9 wide (*Bland*).

*Island of Montserrat* (Sir Rawson W. Rawson).

*Amphibulima rawsonis* Bld., Ann. of the Lyc. Nat. Hist. of N. Y., xi, p. 199 (1875).—Binney, t. c., p. 187, pl. 13, f. C (genitalia), pl. 14, f. E (teeth); Ann. N. Y. Acad. Sci., iii, p. 118, pl. 13, f. H, G (teeth).

This species is most nearly allied in form to *A. pardalina* Guppy, of Dominica. Its radula is characterized by the very great size of the central teeth. I have not seen a specimen.

## Subgenus Rhodonyx Fischer, 1873.

*Rhodonyx* Fischer, Journ. de Conchyl., 1873, p. 325; type *Succinea rubescens*.—*Mastogyra* Ancey, Le Naturaliste, iii, Oct., 1881, p. 484, type *Succinea rubescens*.

Distinguished from typical *Amphibulima* by its regular, *Succinea*-like form, and roseate tint, without color-markings or spots. The anatomy resembles that of *Amphibulima*. It differs from *Succinea* in the corrugated $1\frac{1}{2}$ apical whorls.

A. RUBESCENS (Deshayes). Pl. 61, figs. 26, 27.

Shell *Succinea*-like, thin but moderately strong; rose-tinted corneous, dull, and a little translucent. Sculpture of fine growth-wrinkles decussated by irregular spirals, and short, obliquely descending impressions, most conspicuous below. Whorls $2\frac{3}{4}$, convex, spire short, obtuse. Aperture large, ovate, the lip thin and simple, columella thin, deeply arched.

Alt. 20, diam. 13.5, length of aperture 17 mill.

Alt. 18, diam. 13, length of aperture 15 mill.

Alt. 22, diam. 14 mill. (Desh.).

*Guadelupe* (Deshayes); *Marie Galante* (Schramm, Mazé); *Martinique* (Mazé and others); *Dominica*, 300 ft. elevation (A. D. Brown).

*Succinea rubescens* DESH., in Guérin's Mag. de Zoöl., 1830, p. 4, pl. 4, f. 1, 2; Encycl. Méth., ii, p. 20; Anim. s. Vert., viii, p. 319; Guérin's Icon. Reg. Anim., pl. 6, f. 8, 8 a.—KÜSTER, Conchyl. Cab., *Succinea*, p. 36, pl. 3, f. 34, 35.—PFR., Monogr., ii, p. 531; v, p. 26.—A. D. BROWN, Amer. Naturalist, xv, 1881, p. 57.—SOWERBY, in Conch. Icon., xviii, pl. 4, f. 25 *a*, *b* (1872).—*Helix* (*Cochlohydra*) *rubescens* FÉR., Hist., pl. 9 B, f. 3.

*Amphibulima* (*Rhodonyx*) *rubescens* FISCHER, Journ. de Conchyl. 1873, p. 324 (*S. rubescens*), 325 (anatomy); J. de C. 1874, p. 145–148, pl. 5, f. 13 (animal), pl. 6, f. 1 (jaw), 2, 3 (teeth), 4 (genitalia), 5, 6 (central nervous system).—*A. rubescens* BECK, Index Moll., p. 98.—BINNEY & BLAND, Proc. Acad. Nat. Sci. Phila., 1874, p. 45, pl. 8, f. 2 (jaw), 3 (teeth), 4 (genitalia), specimen from Martinique.—E. A. SMITH, Ann. Mag. N. H. (6), ii, 1888, p. 231.—*Rhodonyx rubescens* MAZE, Journ. de Conchyl. 1883, p. 49.

The locality *Guadelupe*, originally given by Deshayes, has not been verified by later naturalists. Indeed Mazé, who reports it from Marie-Galante, did not himself collect it, and cannot give the exact locality on the island for the three specimens recorded. A. D. Brown reports it as "not common" on Dominica; but none of the other naturalists who have collected on that island found it at all, and there are no specimens in Brown's collection, now in that of the Academy.

The island Martinique is, therefore, the only place where *A. rubescens* seems to be undoubtedly found, and in moderate abundance.

### Subgenus Pellicula Fischer, 1856.

*Pellicula* Fischer, Actes Soc. Linn. Bordeaux, xx, p. 449; type "*Succinea depressa*" (= *appendiculata*).

Shell incapable of containing the soft parts, oval, shaped like a depressed, open *Succinea;* the spire extremely short or depressed, composed of less than two whorls, *smooth;* aperture extremely large, the short, oblique, posterior columella more or less built out in a thin blade-like appendage. Type *Succinea appendiculata* Pfr.

The two species composing this subgenus are very similar in shell characters, *A. depressa* having the spire shorter than in *A. appendiculata*, and the posterior part of the outer lip more dilated; the cuticle being olivaceous or reddish-brown. In *A. appendiculata* the spire projects somewhat more, the color is white or very pale buff, and the appendage on the columella is more strongly developed. Some shells, however, are difficult to assign. In both species the shell is very thin, somewhat pellucid, sculptured with slight growth-wrinkles and some faint, subobsolete spiral impressions. The soft parts offer more satisfactory characters, *depressa* being larger and blackish, with only about 23 plaits on the jaw, while *appendiculata* is smaller, white, with a jaw composed of about 40 plaits.

Dr. Paul Fischer has ably discussed the relationships of the two species, and I have reproduced the descriptions of shells given by him, and those of the animal given by Mazé; merely adding that specimens with the apical characters of *depressa* sometimes have a well-developed columellar appendage.

*Succinea haliotidea* Mittre and *S. aperta* Lea are referred to this group by Pfeiffer (Nomencl. Hel. Viv. 1878, p. 231), though with a mark of doubt. The first is apparently an *Omalonyx*, the second a Hawaiian *Succinea.*

A. appendiculata (Pfeiffer). Pl. 63, figs. 49, 50, 51, 52.

Shell oval, rounded in front, tapering and subrostrate behind, of a whitish color. Spire papillar, projecting. Right margin of the lip not reflexed, inserted on the columella in front of the apex; columellar appendage strongly developed. Length $12\frac{1}{2}$, width 8 mill. (*Fischer.*)

Animal smaller than that of *A. depressa*, at most 40 mill. long; transparent milk-white, with bluish-gray tentacles. (*Mazé*).

Jaw with about 40 folds. (*Fischer, Binney.*)

*Guadelupe:* Mole, entrance of the Grands Fonds (Beau, Schramm, Duchassaing); Morne á l'Eau, woods of the Morne Jensolen (Cayrol); Vieux-Fort, slope of Houelmont, at about 397 metres elevation (E. Marie); Camp Jacob, cascade Vauchelet, Canal Dupuy, ravine Roche (Bavay, Schramm, Marie), at about 500–700 meters elevation; Matouba, chute of the Saint Louis river (Schramm); Gourbeyre, Morne du Palmiste (Marie); Capesterre, bords du Grand Étang (Bavay, Mattei).

*Succinea appendiculata* Pfr., Zeitschr. f. Malak., 1847, p. 146; Monogr., ii, p. 531; v, p. 24; Conchyl. Cab., p. 38, pl. 4, f. 3, 4.—Bland & Binn., Ann. Lyc. N. H. of N. Y., x, 1873, p. 206, pl. 9, f. 2 (jaw), 6 (shell), 9, 10 (teeth), 11 (an alcoholic specimen).—*Pellicula depressa* Fischer, Actes Soc. Linn. Bordeaux, xx, 1856, p. 449, pl. 6, f. 5–11 (anatomy); Journ. de Conchyl., 1874, p. 148–155, pl. 5, f. 1, 2, 3 (living animal), 4 (jaw), 5, 6 (teeth), 7 (genitalia).—Petit, Journ. de Conchyl., 1856, p. 154.—*Pellicula appendiculata* Fischer, Journ. de Conchyl., 1875, p. 277, pl. 14, f. 1 (shell).—Mazé, J. de C., 1883, p. 23.—*Omalonyx appendiculata* H. & A. Adams, Gen. Rec. Moll., ii, p. 131.—*Amphibulima appendiculata* Binney, Proc. Acad. Nat. Sci. Phila., 1874, p. 42, pl. 8, f. 5 (genitalia), 6 (teeth); Ann. N. Y. Acad. Sci., iii, p. 119, pl. 15, f. F (jaw), pl. 13, f. E (teeth).

The shell differs from *A. depressa* chiefly in having the spire projecting more above the insertion of the outer lip, and the columellar appendage usually more developed. The living animal is smaller and its jaw has many more plaits. It is a species of the lowlands, while *A. depressa* lives at a considerable elevation on the mountains.

Two specimens before me measure: length 14, breadth 9.5 mill., and length 12.4, breadth 8 mill.

A. depressa (Rang). Pl. 63, figs. 53, 54, 55.

Shell oval, rounded and dilated in front, tapering and subtruncate behind; greenish, more or less olivaceous or brownish; spire a little projecting, sometimes sunken. Right margin thin, slightly reflexed toward the interior, dilated at the spire and projecting beyond the apex, at its junction with the columella. Columellar appendage thin,

but feebly developed. Length 13–14, width 9–9½ mill. (*Fischer*). Living animal measuring 45–60 mill. long when extended, of a uniform black color (*Mazé*).

Jaw with about 23 folds (*Fischer*).

*Guadelupe:* Massif de la Soufrière, plateau of the central cone, northeast of the Grande Crevasse, slopes of the As-de-Pique, morne Goyavier, 959 to 1380 meters elevation (Schramm, E. Marie, Longueteau); Capesterre, chutes of the Grand Carbet river (Longueteau). Also on *Saint Martin*, morne Paradis (P. Kohlmann), at 410 meters elevation, on leaves of bushes and herbs, and moist rocks.

*Succinea depressa* Rang, Guérin's Mag. de Zoöl., 1834, pl. 55.—Pfr., Monogr., ii, p. 531; v, p. 24.—*Omalonyx depressa* H. & A. Ads., Gen. Rec. Moll., ii, p. 131.—*Pellicula depressa* Fischer, Journ. de Conchyl., 1875, p. 276, pl. 14, f. 2 (shell).—Mazé, J. de C., 1883, p. 23; 1890, p. 27.

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B. californicus Rve (page 40), reference to plate should be *pl. 9*, not "pl. 49."

Oxystyla maracaibensis Pfr. (p. 137, 138).

Add to synonymy: ? *Orthalicus undatus* Brug., Gibbons Journ. of Conchology, ii, p. 130 (in part).

*Chersina venosa* Humphrey, Mus. Calonnianum, p. 63, is an unidentifiable Mexican *Oxystyla*.

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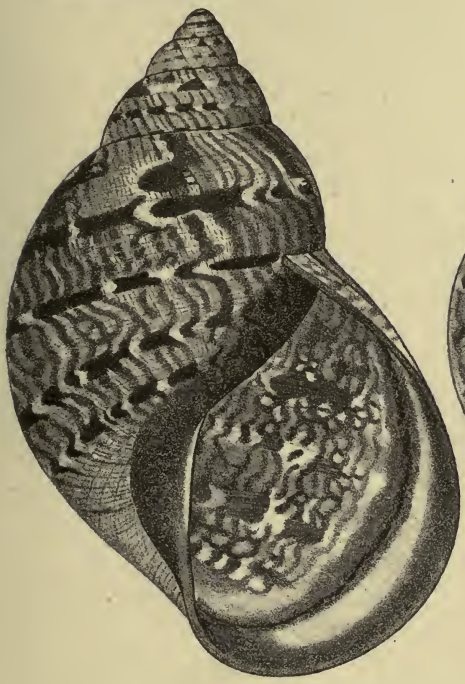

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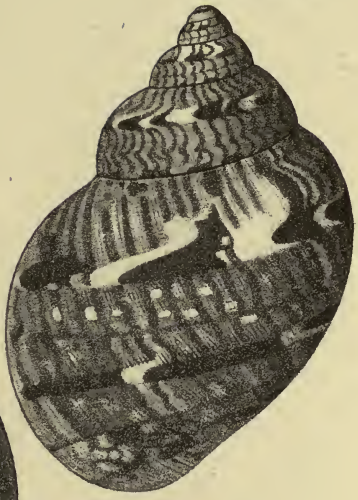

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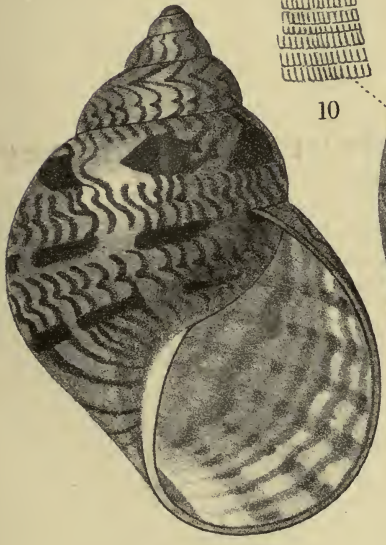

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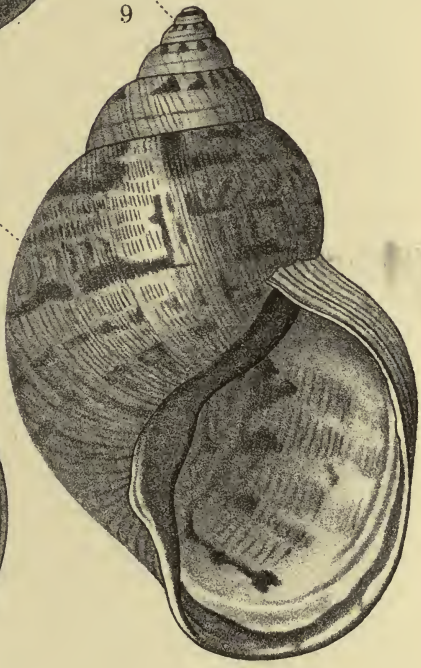

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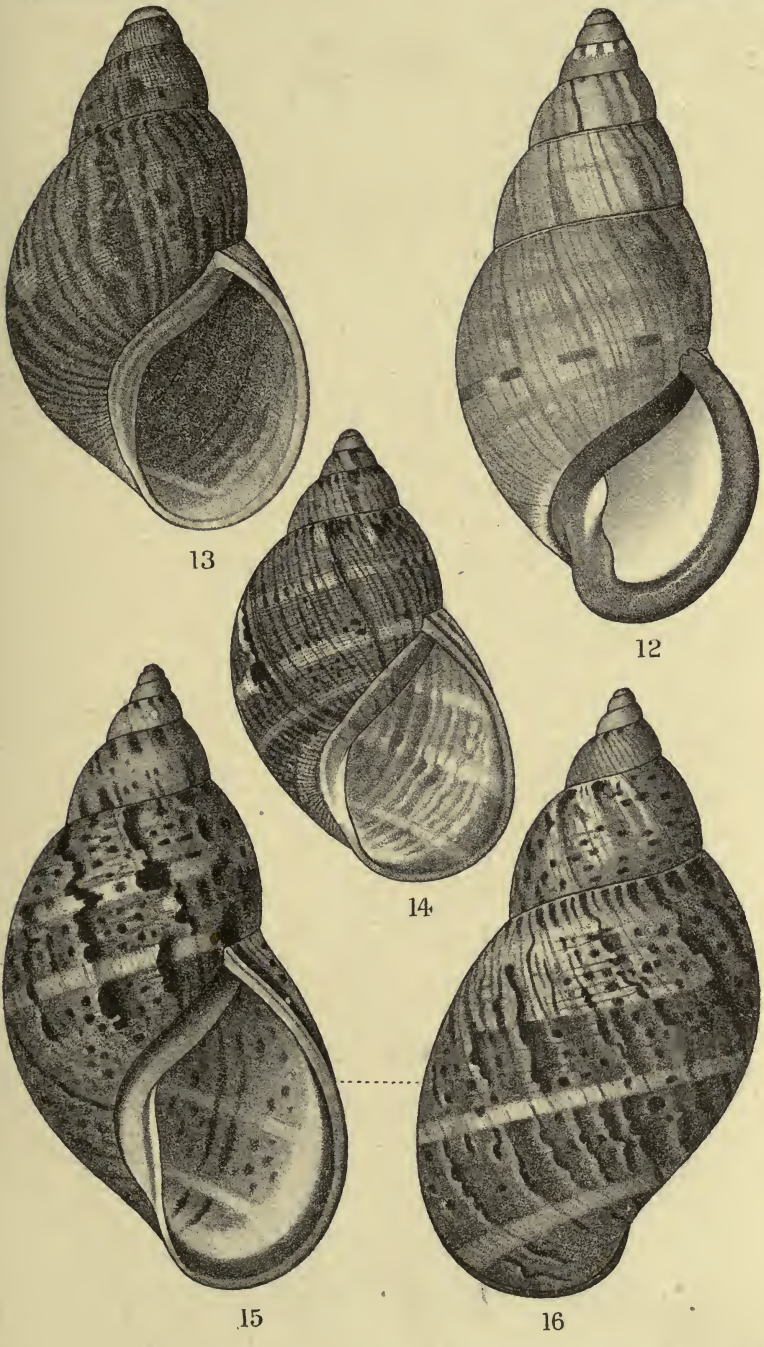

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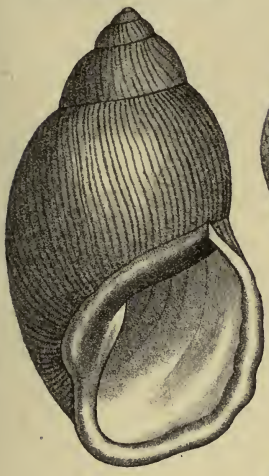

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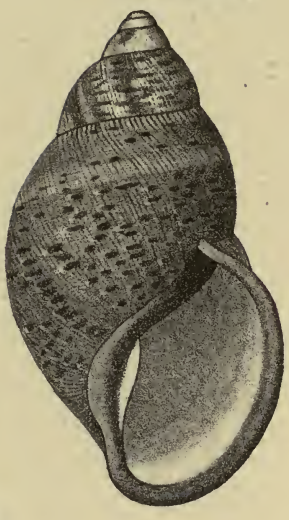

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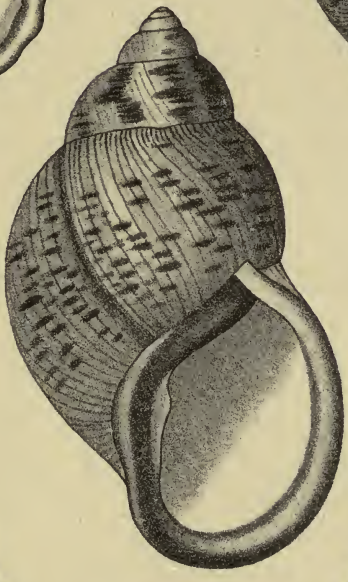

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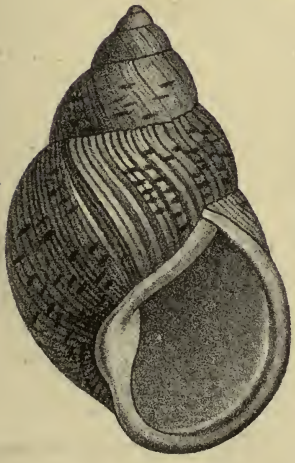

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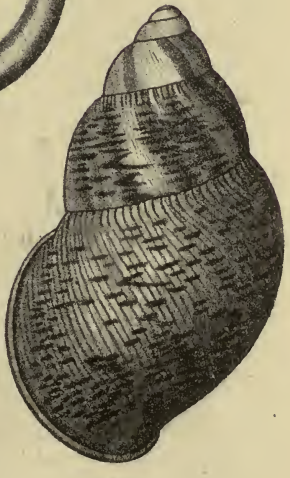

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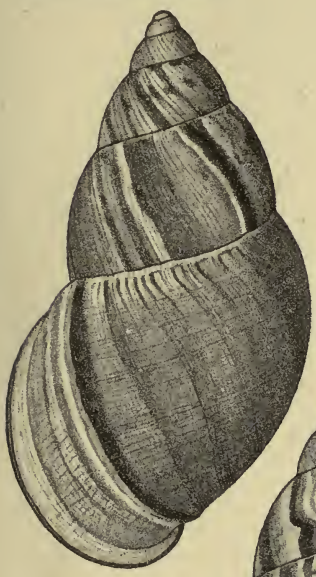

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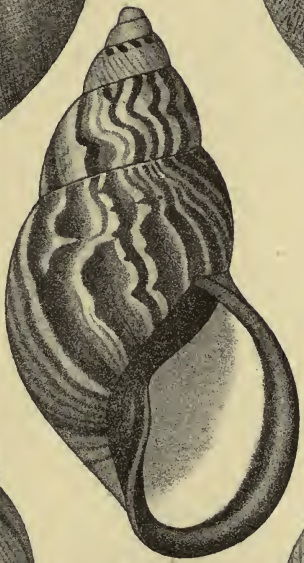

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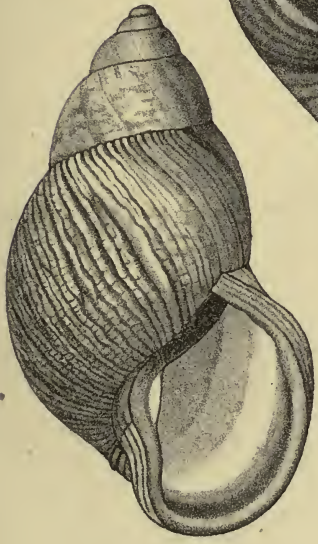

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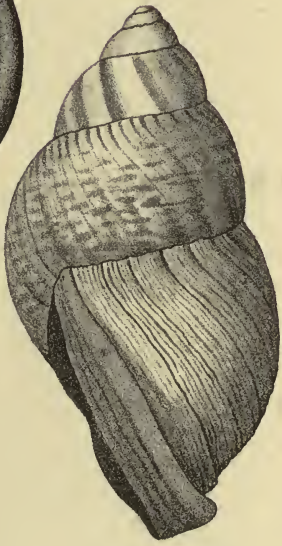

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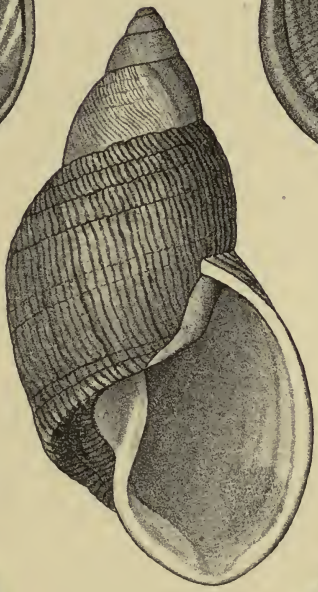

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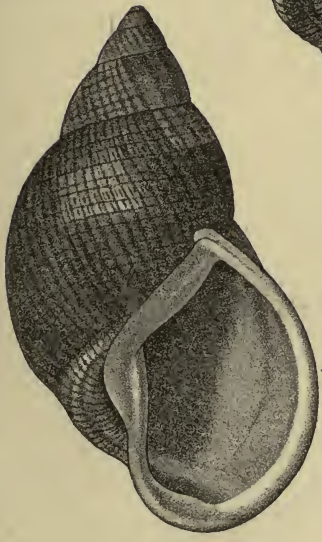

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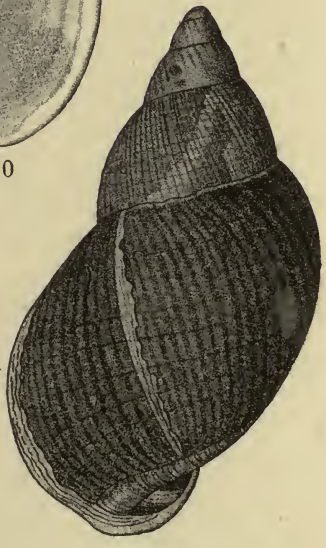

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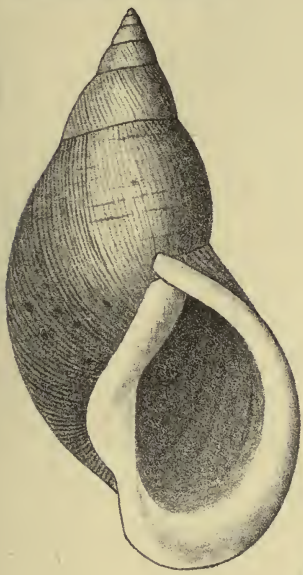

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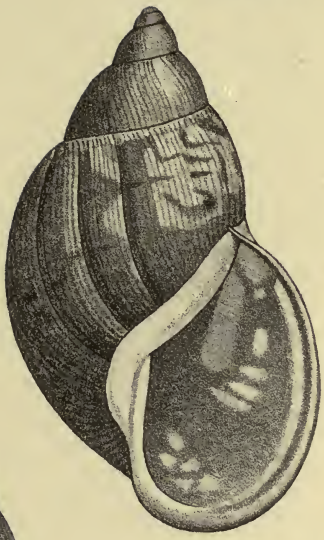

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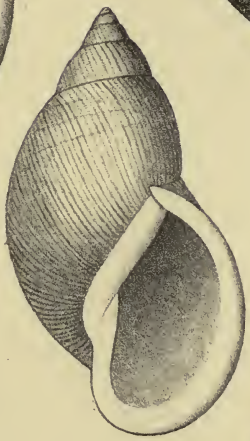

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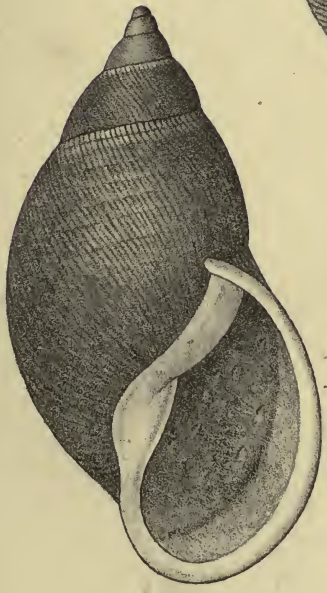

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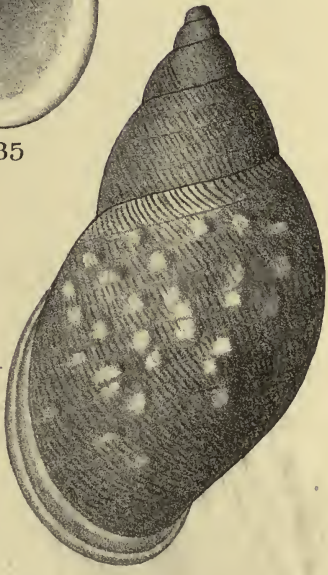

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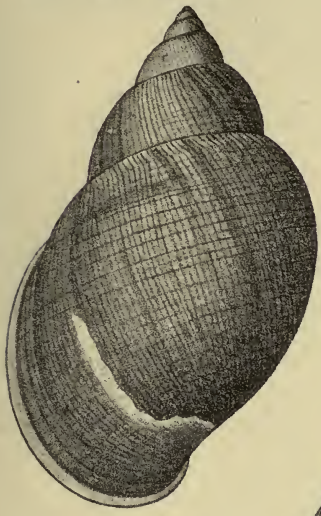

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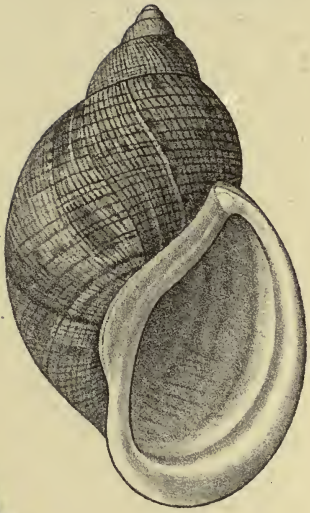

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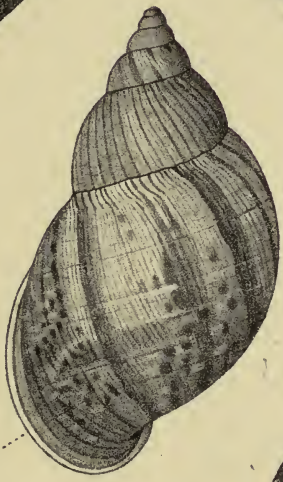

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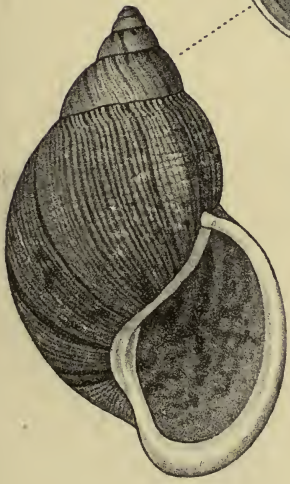

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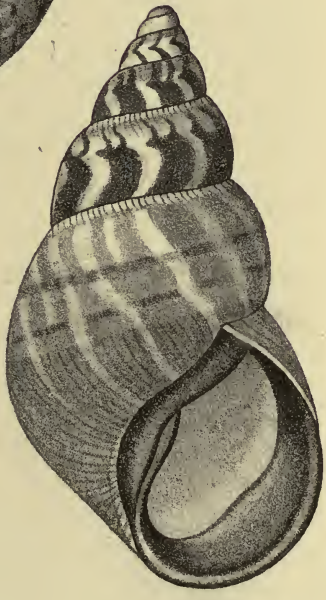

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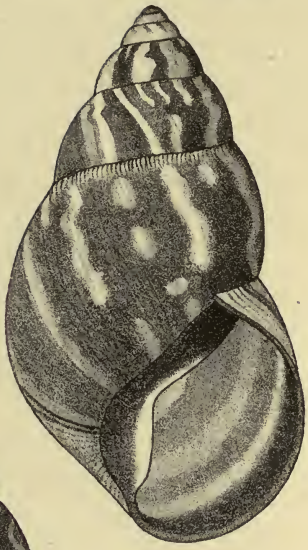

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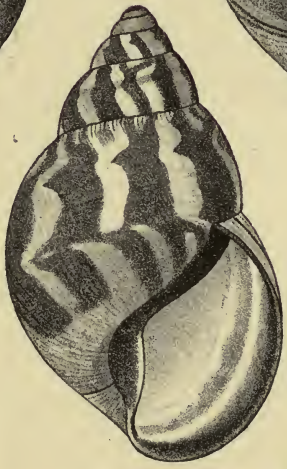

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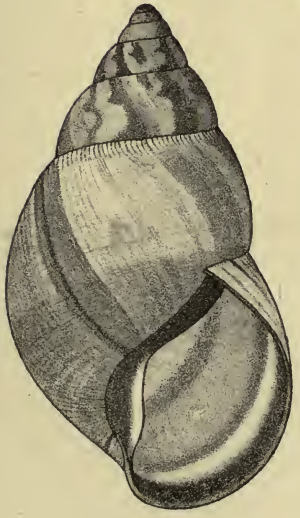

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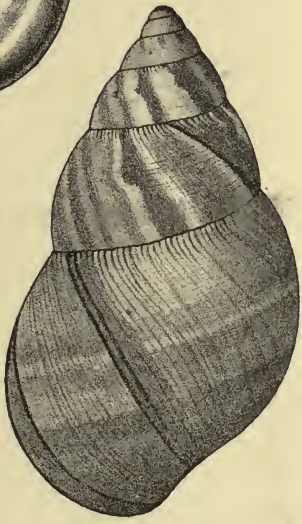

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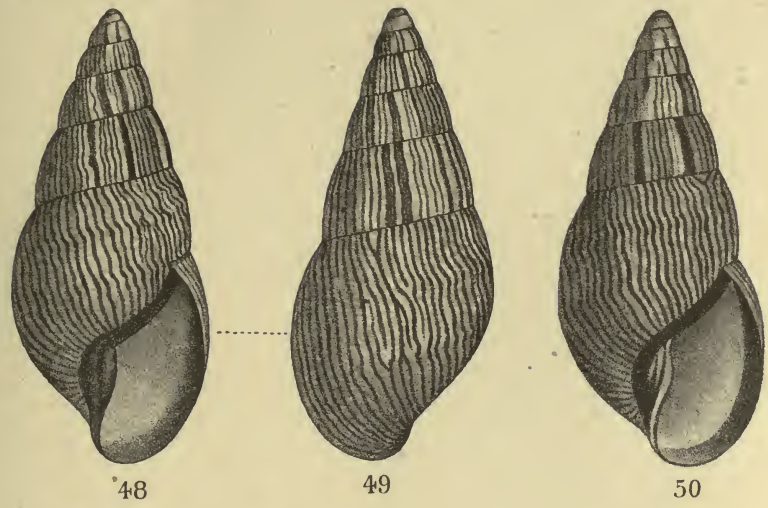

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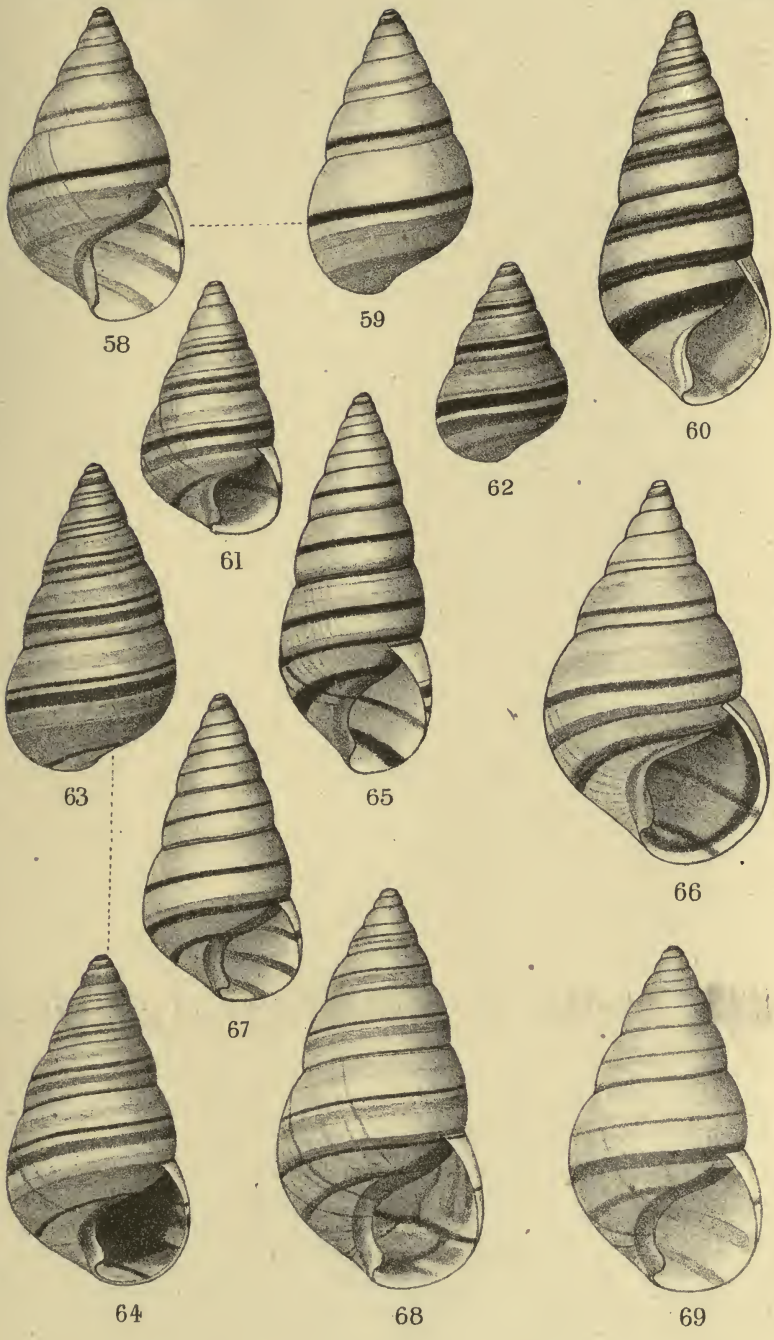
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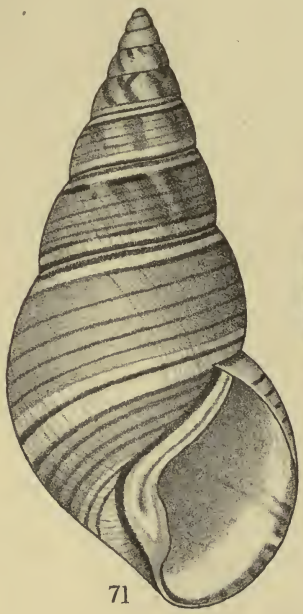

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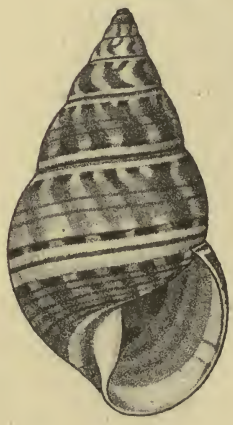

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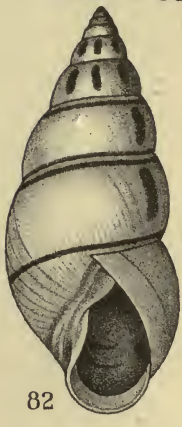

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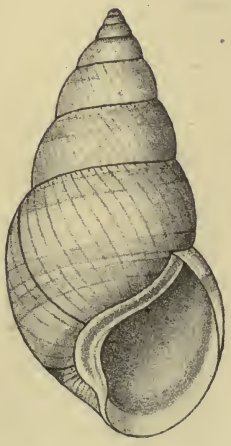

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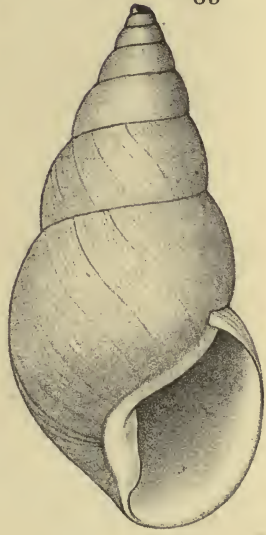

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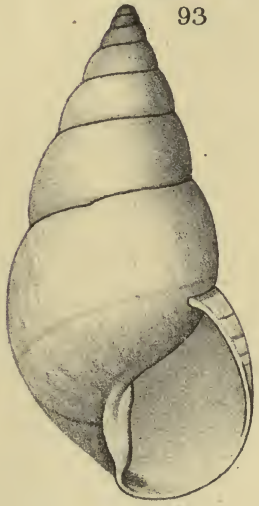

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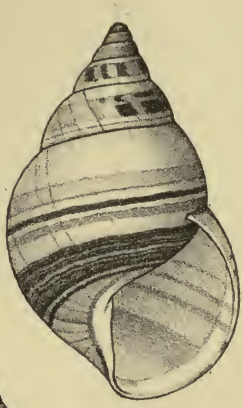

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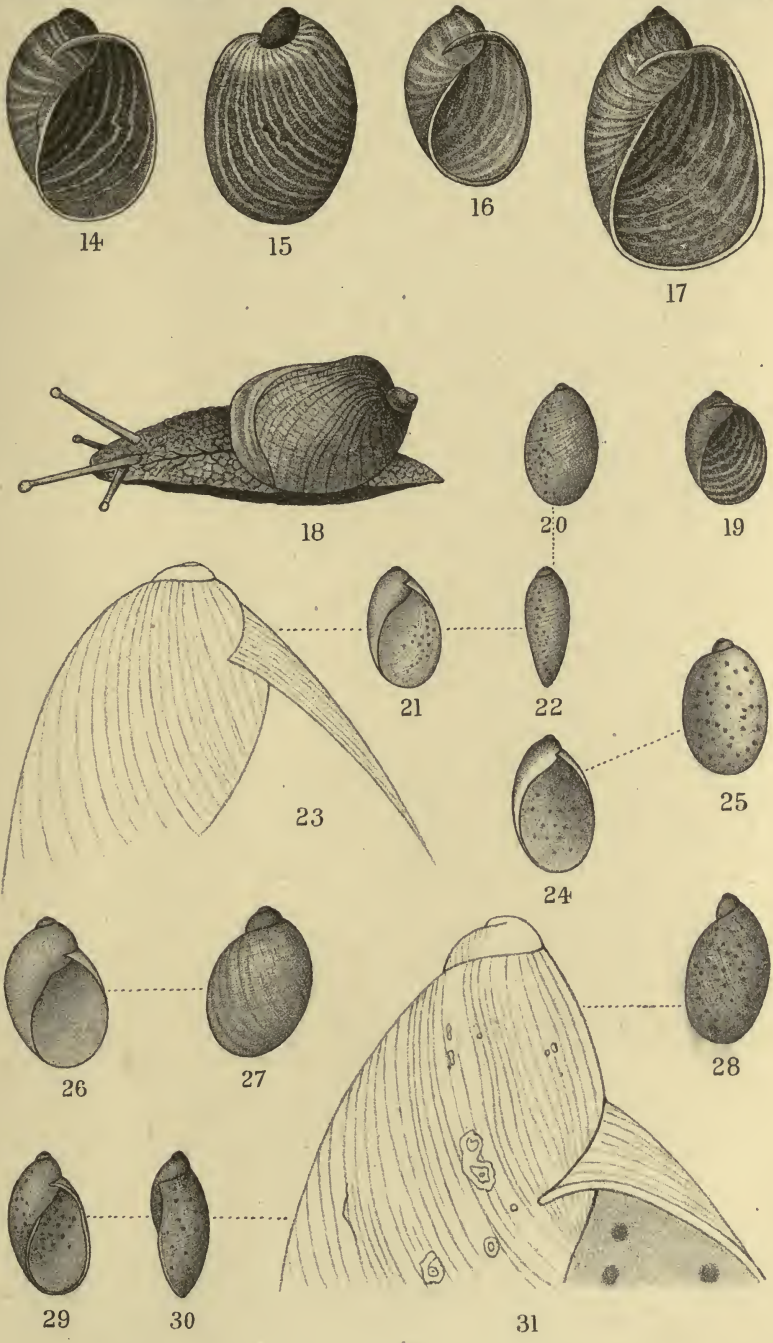
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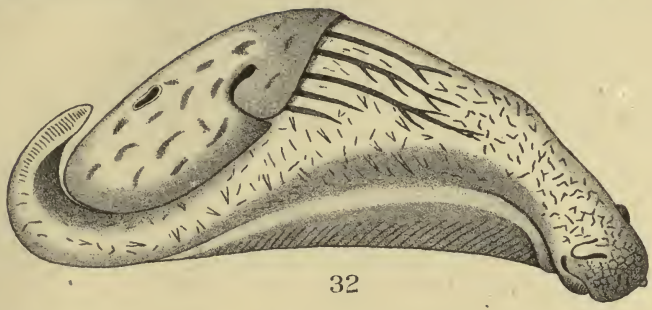

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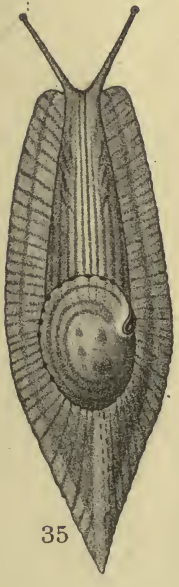

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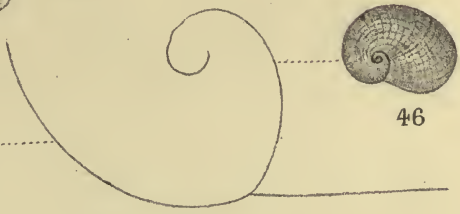

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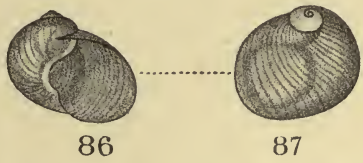
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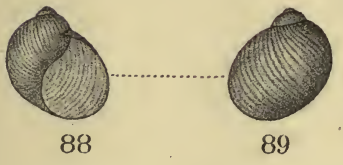
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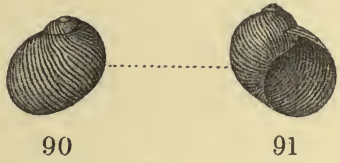
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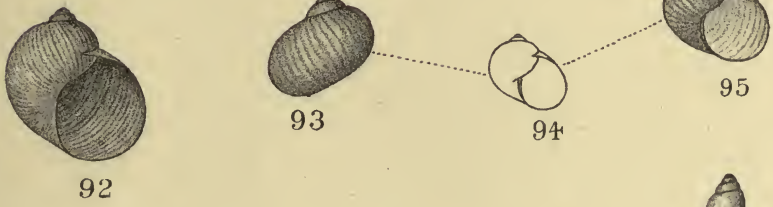
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